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Essays on Dynamic Political Economy

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Essays on Dynamic Political Economy

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Dedicated to my wife Rachel.

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Essays on Dynamic Political Economy

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The unifying theme of this dissertation is the empirical analysis of American politics. In particular, I use economic models to provide theoretically sound and empirically valid answers to political questions that are dynamic in nature. The first chapter focuses on the role of the seniority system in pork barrel politics and the subsequent effect on the quality of Representatives in the U.S. House. The second chapter analyzes candidate positioning in a dynamic environment where there are electoral costs to changing position. The third and final chapter is a test of the role of political parties in time consistency problems when candidates cannot commit to future policies. Collectively, these chapters extend the research of empirical political economy in an important direction, one that accounts for the inherent dynamics of politics.

Table of Contents

List of Tables

List of Figures

Chapter 1

The Price of Pork: The Seniority Trap in the U.S. House

From 1983 to 1995, J.J. Pickle served his eleventh to sixteenth terms in the United States House of Representatives. He was the third ranking Democrat on the House Committee on Ways and Means. Each term, Pickle directed over $7,300 per capita in newly awarded, discretionary spending to the 10th district of Texas. By this measure, he was one of the most influential members of Congress; achieving a level of discretionary spending for his district that was over thirteen times the average.

Pickle's story is typical of the popular view of pork barrel politics; senior Congressmen, and Congressmen with seats on important committees greatly influence the geographical allocation of federal spending. Such a view has prompted policy groups and academics to worry over the inefficiencies that might result from such influence. Senior members of Congress can direct federal spending towards their district, but this funding comes at the expense of districts with junior representatives and the net transfer is zero. Given that voters care about spending in their district, they set lower standards on incumbents than on challengers because incumbents are better able to manipulate the pork barrel. However, slacker standards on incumbents leads to a welfare loss; the average quality of those in office goes down, but the net

transfer of federal outlays is zero. Elhauge, Lott, and Manning (1997) call this the "seniority trap".

The objective of this paper is to estimate the effect of the seniority trap on the quality of representatives in the U.S. House. I develop a dynamic, structural model of the voters' decisions and estimate the parameters governing the unobservables through an indirect inference approach. A dynamic, structural model is necessary because seniority creates a dynamic linkage across periods and because candidate quality is unobserved by the econometrician. I use data from the Federal Assistance Awards Data System (FAADS) and data on House election outcomes to estimate the model. Such an approach also has the advantage of allowing me to conduct policy experiments, using the model to test counterfactuals. Following estimation I conduct three policy experiments: reform of the seniority system, institution of term limits, and the institution of a tax on seniority.

Contrary to conventional wisdom, I find that the seniority system, by the most reasonable estimates, has a small effect on the quality of candidates in office for two reasons. First, the returns to seniority in terms of federal outlays are small. I find that an additional term of tenure in the House increases federal outlays in a district by only about $2 per capita and that an additional term of tenure on a prestigious committee increases federal outlays in a district by $59 per capita. Second, the probability that a representative is re-elected does not increase significantly as he gains seniority. An incumbency advantage exists, but almost all of this advantage accrues during the Congressman's first term (Dawes and Bacot (1996)). Furthermore, the most common solution to the seniority trap, proposed by policy groups and academics, is term limits

(see, for example, Elhauge, Lott, and Manning (1997) and Bernhardt, Dubey, and Hughson (2004)) which are found to have a relatively large, negative impact on the quality of representatives in office. Indeed, when I account for candidate quality, my results are in direct opposition to the proponents of term limits. I find that as the amount of pork increases, term limits become even more costly. Instead of term limits, I propose a Pigouvian tax on seniority. Such a system achieves the first-best outcome; eliminating the wedge between incumbents and challengers that results from the pork barrel and allowing high quality candidates to stay in office indefinitely.

The main contribution of this work is to quantify the costs of the seniority trap. Bernhardt, Dubey, and Hughson (2004) suggest that the ability of members of Congress to influence discretionary spending accounts for the difference in incumbent re-election rates between governors ($\sim$70%) and Congressmen (over 90%). Levitt and Jr. (1997) find that an increase of $100 per capita in federal pork increases a representative's vote share by 2%. Couple this with the influence on spending shown by J.J. Pickle or the returns to seniority estimated by Falk (2005) (over $200 per capita per year) and one would likely infer that the seniority trap has a large effect on election outcomes and the quality of representatives in office. Furthermore, the Republicans' "Contract with America", and academic work such as Dick and Lott (1993), Elhauge, Lott, and Manning (1997), and Bernhardt, Dubey, and Hughson (2004) suggest that the costs of the seniority trap are large enough to warrant term limitations on Congressmen. The work that follows is the first to quantify the costs of the seniority trap as well as the costs and benefits associated with potential solutions to the trap such as term limits and a tax on seniority.

An additional contribution of this paper is to identify the relationship between seniority on prestigious committees and the ability to control discretionary spending. While many have controlled for the influence of committee membership or seniority in the House (Stein and Bickers (1994), Alvarez and Saving (1997a), Levitt and Poterba (1999), Falk (2005)), no one, to the best of my knowledge, has controlled for seniority on a committee. Roberts (1990) provides an analysis of the death of Senator "Scoop" Jackson and its effect on the prices of securities for firms in Jackson's state and in the state of his successor, Sam Nunn. Roberts (1990) does find a positive effect of committee seniority in this particular case, however, I have not found a study that uncovers such a relationship in a larger sample. Given the story that underlies the models of seniority, that seniority influences funds through its impact on committee assignments and leadership positions on committees, one should expect a relationship between committee seniority and discretionary spending. Like others in the literature, I find a statistically and economically small effect of seniority on federal spending. The relationship between seniority on a prestigious committee and federal outlays is much stronger and reflects the interaction between the seniority system and the committee structure in the House.

The remainder of the paper proceed as follows. Section 1 introduces the models of voter choice. Section 2 discusses the data used and Section 3 outlines the estimation strategy. Section 4 presents the results of the estimation. Section 5 describes the policy experiments and Section 6 discusses some extensions to the model. Section 7 concludes.

1.1 Model

I consider two models of incumbency. I call the first the naïve model of seniority. In this model, federal outlays are a function of the number of terms a representative has spent in Congress, plus some stochastic term. The seniority-funds relationship in the naïve model is similar to the relationship between seniority and funds estimated by Stein and Bickers (1994), Alvarez and Saving (1997a), Levitt and Poterba (1999), and Falk (2005), among others. In the naïve model and in the models of those listed, it is seniority in the House that affects a member of Congress' ability to direct funds. The second model is a model of committee seniority. In this model, federal outlays are a function of committee seats and seniority on committees. Many, including Alvarez and Saving (1997a), find that committee seats are an important determinant of the amount federal outlays a district receives. The literature on committee seniority and its relation to funds is not as well researched as the naïve model of seniority, but Roberts (1990) finds support for the influence of committee seniority in an event study of Senator "Scoop" Jackson's death. Additionally, the relationship between committee seniority and Congressional influence is well documented in such works as Cox and McCubbins (2007).

In both models, voters care only about the flow of federal outlays to their district and the quality of the candidate. Quality is specific to the match between the candidate and the district. The model is similar in spirit to the dynamic labor-search models with a job-specific match component and returns to tenure (e.g. Adda, Dustmann, Meghir, and Robin (2002)). One can think of quality as the ability of the politician to represent the interests of the district in areas other than at the pork

barrel. Bernhardt, Dubey, and Hughson (2004) and Elhauge, Lott, and Manning (1997) refer to this quality component as the ideological fit of the Congressman and that is certainly a component to the quality measure in this model, although I cannot identify the role of each factor that contributes to the quality measure. It is everything the voters like about the politician that is not his ability to direct federal funds to the district. Like Bernhardt, Dubey, and Hughson (2004), I ignore the aggregation of ideologies in the House, which is an issue beyond the scope of the paper.[1] Because the characteristics of the electorate may shift over time and because the ideological position and influence of an elected official may change, I allow the quality of a candidate to evolve over time, with a degree of persistence.

The decision I model is that of the decisive voter.[2] Each district's decisive voter chooses between an incumbent and a challenger (or between two new candidates in the case of an open election). At the time of the vote, the voters perfectly observe the quality of each candidate and have an expectation of the funds the candidate will be able to direct to the district based on the seniority and/or committee membership of the candidate. The modeling choices capture the mechanisms at work in the models of Dick and Lott (1993), Elhauge, Lott, and Manning (1997), Mao (2001), and Bernhardt, Dubey, and Hughson (2004), and the story of a costly seniority trap. Voters have perfect information about the candidates' quality at the time of the

[1] If the aggregation of ideologies in the House is at least partially a zero-sum game, then one can interpret my results as placing an upper bound on importance of quality. That is, I find the largest inefficiencies that the seniority trap might cause and the largest costs to policies that lower candidate quality.

[2] I do not take not stand on the distribution of voter preferences or candidate positioning. Thus whatever the model is (e.g. representative agent or median voter), I am abstracting from the process and choosing to model only the pivotal voter from the underlying model.

election.

The models I present are similar to the model in Gowrisankaran, Mitchell, and Moro (2008). Both Gowrisankaran, Mitchell, and Moro (2008) and I model elections as a dynamic, discrete choice by a decisive voter and we share a similar description of candidate quality. Differences include their assumption of fixed candidate quality, whereas my model allows quality to evolve over time.[3] In addition, I assume challengers are drawn from the same distribution whether the election is an open election or not.[4]

I present both models formally below; starting with the model of naïve seniority.

1.1.1 Naïve Seniority

The voter discounts future by β and his instantaneous utility is given by:

$$u(f(T_{i,t}, \epsilon_{i,t}), \eta_{i,t}) = f(T_{i,t}, \epsilon_{i,t}) + \eta_{i,t} \tag{1.1}$$

Where $T_{i,t}$ is the tenure of the incumbent in district i at time t. The function $f(\cdot, \cdot)$ represents the dollars of federal outlays per capita for district i in period t, which are a function of both the tenure of the incumbent and a stochastic term, $\epsilon_{i,t}$. The

[3]The assumption of fixed quality is overly restrictive and does not account for, among other factors, changes in the make-up of the electorate over time

[4]Gowrisankaran, Mitchell, and Moro (2008) argue that the incumbency advantage is largely due to the lower quality challengers they face, but the effect of incumbents on the quality of challengers does not have a consensus view. Cox and Katz (1996) find only a small amount of the incumbency advantage can be attributed to a "scare-off" effect, with most of the advantage being driven by the quality of incumbents. I discuss the assumption further in Section 6.

parameter $\eta_{i,t}$ is the quality of the incumbent, measured in dollars of federal outlays. At the time of the election, I assume that voters can perfectly observe the quality of a candidates. The quality of the incumbent is allowed to evolve over time following a mean reverting process. Specifically, the law of motion for the incumbents quality is:

$$\eta_{I,t} = (1-\rho)\mu + \rho\eta_{I,t-1} + u_{I,t} \tag{1.2}$$

Where μ is the mean of the quality distribution, ρ is the persistence parameter for the AR(1) process, and $u_{I,t} \sim N(0, \sigma_u^2)$. One can think of the quality of the incumbent as his ability to represent the district. Thus the evolution of this variable can be due to both changes to the Congressman's productivity and his ideological position and changes in the socioeconomic make-up of the district that shift the preferences of the electorate. The quality of challengers, η_C, is distributed $N(\mu, \sigma_\eta^2)$.

I abstract from the decisions of Congressmen and parameterize the funds production function $f(\cdot,\cdot)$ as follows:

$$f(T_{i,t}, \epsilon_{i,t}) = \alpha_1 + \alpha_2 T_{i,t} + \alpha_2 T_{i,t}^2 + \epsilon_{i,t} \tag{1.3}$$

The parameter α_1 is the mean federal outlays per capita for districts with freshman representatives and α_2 and α_3 describe the return to a term of seniority in the House, in terms of federal outlays. I assume that the effect of tenure on one's ability to manipulate the pork barrel is the same for all Congressmen with 15 or more terms. This bounds the problem and is a legitimate assumption given that the benefits from seniority are relative to the distribution of tenure and very few representatives have

over 15 terms of tenure in any Congress. The stochastic portion of funds is not realized until after the election and is distributed as $\epsilon_{i,t} \sim N(0, \sigma_\epsilon^2)$.

Voters are rational and forward looking. Every election cycle, they must make a choice between an incumbent and a challenger. Let the value of a vote in an election with an incumbent running be:

$$V^E(T_I, \eta_I, \eta_C) = max[V^I(T_I, \eta_I), V^C(0, \eta_C)] \tag{1.4}$$

Let the value of a vote in an open election be:

$$V^{OE}(0, \eta_C, \tilde{\eta}_C) = max[V^C(0, \eta_C), \tilde{V}^C(0, \tilde{\eta}_C)] \tag{1.5}$$

$V^I(T_I, \eta_I)$ and $V^C(0, \eta_C)$ represent that value of electing an incumbent and challenger (for given tenure and quality), respectively. Subscripts I and C on tenure and quality variables indicate whether the variable is for the incumbent or challenger. The tilde over $\tilde{V}^C$ and $\tilde{\eta}_C$ differentiates between the two challengers in an open election. Both candidates in such elections have zero tenure, but may differ in quality.

The Bellman equation for the value of electing an incumbent is written as:

$$\begin{aligned} V^I(T_I, \eta_I) = E_\epsilon u(f(T_I, \epsilon), \eta_I) + \delta_{T_I} \beta E_{\eta_C', \tilde{\eta}_C'} V^{OE}(0, \eta_C', \tilde{\eta}_C') \\ + (1 - \delta_{T_I}) \beta E_{\eta_I', \eta_C' | \eta_I} V^E(T_I + 1, \eta_C', \eta_I') \end{aligned} \tag{1.6}$$

The first term in Equation 1.6 is the expected utility flow from the next term if the voter elects an incumbent with T_I terms of tenure. Because the voter does not observe federal outlays before the election, he maximizes the expected utility of electing the incumbent. The second and third terms of Equation 1.6 describe the continuation value

from electing an incumbent and are thus discounted by the time preference parameter β. One-period ahead values for parameters are denoted by a prime. Expectations are taken over the probability of retirement and candidate quality for future elections. If an incumbent retires, which occurs with probability δ_{T_I}, the next period election is open.[5] With probability $1 - \delta_{T_I}$, the incumbent runs in the following election.

The Bellman equation for the value of electing the challenger is written as:

$$\begin{aligned} V^C(0, \eta_C) = E_\epsilon u(f(0, \epsilon), \eta_C) + \delta_0 \beta E_{\eta_C', \tilde{\eta}_C'} V^{OE}(0, \eta_C', \tilde{\eta}_C') \\ + (1 - \delta_0) \beta E_{\eta_I', \eta_C' | \eta_C} V^E(1, \eta_C', \eta_I') \end{aligned} \tag{1.7}$$

Equation 1.7 is the much the same as Equation 1.6 but the tenure of a challenger is always zero. Thus the first term in Equation 1.7, the expected utility flow from the next term if the voter elects a challenger, is the utility from having a freshman representative with quality η_C. The continuation value is similar to that in 1.6, the difference being the seniority of a challenger.

Equation 1.1 to Equation 1.7 completely describe the dynamic programming problem that the decisive voter solves in the naïve model of seniority.

Figure 1.1.1 displays the relationship between the per capita amount awarded to a district per term and the tenure of the district's representative. While more senior members tend to have higher outlays per capita, the relationship between tenure and funds is not strong. The unconditional correlation between tenure and federal outlays is 0.035 in the sample period. The tenuous relationship is consistent with much of the

[5]The parameter δ is truly the probability of non-electoral exit from office. This may be due to death, scandal, or voluntary exit. I use the term retirement throughout, although that is not the strict definition of the parameter.

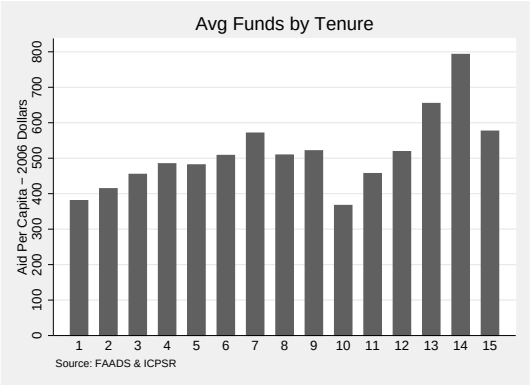

Figure 1.1: Returns to House Seniority

literature on the congressional pork barrel, many of whom find a weak relationship between seniority and federal outlays (Stein and Bickers (2007), Alvarez and Saving (1997a), Levitt and Poterba (1999)).

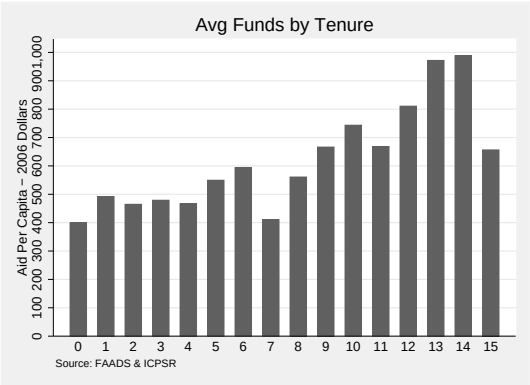

Figure 1.2: Returns to Committee Seniority

Alvarez and Saving (1997a) find a more significant relationship between seats on select House committees and federal outlays. In particular, seats on the Committee on Ways and Means, the Committee on Appropriations, the Committee on Armed Services, the Committee on Natural Resources, and the Committee on Small Business

are important determinants of a district's outlays. I find that members of these influential committees also enjoy an increasing ability to direct funds to their district as their tenure on the committee increases. Figure 1.1.1 shows the average per capita funds from new awards of high variation programs by committee tenure.[6] A much stronger relationship is present with committee tenure than with overall tenure in the House. Such a relationship is consistent with the story of seniority being important due to its role in the committee system. By using overall tenure in the House as a proxy, the relationship between seniority and the ability to control federal spending is attenuated since many Congressmen may not have obtained seats on powerful committees. By focusing on the role of seniority on these prestigious committees, the relationship between seniority and control of discretionary funds is much stronger. I now turn to a less stylized model where Congressman obtain committee seats and with an active seniority system within committees.

1.1.2 Committee Seniority

In the model of committee seniority, funds are a function of committee membership and seniority on powerful committees. Committee membership is given by a dummy variable indicating the Congressman sits on a powerful committee. Let the funds function $f(\cdot,\cdot,\cdot)$ be described as follows:

$$f(T_{i,t}, comm_{i,t}, \epsilon_{i,t}) = \alpha_1 + \alpha_2 T_{i,t} + \alpha_3 T_{i,t}^2 + \alpha_4 comm_{i,t} + \epsilon_{i,t} \tag{1.8}$$

As in the naïve seniority model, $T_{i,t}$ is seniority, but here it represents the

[6] If a Congressman is serving on more than one of these committees I define his tenure to be the maximum tenure of the committees he sits on.

seniority on a prestigious committee of the incumbent representing district i at time t. $comm_{i,t}$ is a dummy variable indicating membership on a prestigious committee and $\epsilon_{i,t}$ is the stochastic portion of federal outlays. The parameters α_1 is the mean federal outlays per capita to districts with representatives that do not have a seat on a prestigious committee. α_2 and α_3 measure the returns to a term on a prestigious committee and α_4 is the return to a seat on a prestigious committee. To bound the problem, and because seniority is relative, it is assumed that returns to tenure end after a 15 terms on the committee.

Let the value of a vote in an election with an incumbent be:

$$V^E(T_I, comm_I, \eta_I, \eta_C) = max[V^I(T_I, comm_I, \eta_I), V^C(0, 0, \eta_C)] \tag{1.9}$$

Let the value of a vote in an open election be:

$$V^{OE}(0, 0, \eta_C, \tilde{\eta}_C) = max[V^C(0, 0, \eta_C), \tilde{V}^C(0, 0, \tilde{\eta}_C)] \tag{1.10}$$

The Bellman equation for the value of electing an incumbent can be written as:

$$\begin{aligned} V^I(T_I, comm_I \eta_I) = E_\epsilon E_{comm'_I|comm_I} u(T_I, comm'_I, \eta_I, \epsilon) + \\ \delta_{T_I} \beta E_{\eta'_C, \tilde{\eta}'_C, comm''} V^{OE}(0, 0, \eta_C, \tilde{\eta}_C) \\ +(1 - \delta_{T_I}) \beta E_{\eta'_I, \eta'_C, comm''_I|\eta_I, comm'_I} V^E(T_I + 1, comm'_I, \eta'_C, \eta'_I) \end{aligned} \tag{1.11}$$

Expectations are taken over candidate quality, federal outlays, retirement, and committee membership. Committee assignments are not revealed until after the election. I assume the assignments follow a first order Markov process that is conditional

Table 1.1: Committee Assignment Process

	$comm_{t+1}=0$	$comm_{t+1}=1$
$comm_t=0$	$1-\pi_c(T_H)$	$\pi_c(T_H)$
$comm_t=1$	$1-\pi_{cc}(T_C)$	$\pi_{cc}(T_C)$

on seniority in the House and seniority on a prestigious committee. The Markov process is summarized in Table 1.1, where $\pi_c(T_H)$ is the probability of obtaining a seat on a prestigious committee conditional on T_H terms of tenure in the House and $\pi_{cc}(T_C)$ is the probability of retaining seat on a prestigious committee given T_C terms of tenure on a prestigious committee. The first term in Equation 1.11 is the expected flow of utility for the next term when the incumbent remains in office. The last two terms are the expected present value of future elections, conditional on electing the incumbent in the current period.

The Bellman equation for the value of electing a challenger has the same structure and can be written as:

$$\begin{aligned} V^C(0,0,\eta_C) = E_\epsilon E_{comm'_I|0} u(0, comm'_C, \eta_C, \epsilon) + \\ \delta_0 \beta E_{\eta'_C, \tilde{\eta}'_C, comm''} V^{OE}(0,0,\eta_C,\tilde{\eta}_C) \\ +(1-\delta_0)\beta E_{\eta'_I,\eta'_C,comm''_I|\eta_C,comm'_C} V^E(1, comm'_C, \eta'_C, \eta'_I) \end{aligned} \tag{1.12}$$

Equation 1.1 and Equations 1.8 to 1.12 completely describe the dynamic programming problem that the decisive voter solves in the committee seniority model.

1.2 Data

Estimation of the model requires data on election outcomes, Congressional tenure, and federal spending by district. District population data are also required,

as the decisions are those of an individual voter and thus it is easier to speak of funding in per capita terms. My data come from four main sources. I briefly discuss the data-sets from which election outcomes, congressional tenure, and district population are gathered. The federal funding data necessitates a longer discussion.

The Census Bureau provides district level population data, which allows one to put the federal outlays in per capita terms. Data on election outcomes and political action committee (PAC) contributions come from the Federal Election Commission's (FEC) Campaign Summaries files. Vote share of the winning candidate is used to proxy for effort due to electoral vulnerability when estimating the role of tenure in determining federal outlays. The regression analysis controls for PAC contributions in order to account for the influence of special interests on federal outlays. The FEC's data are available from 1982-2006.

The United States Congressional Biographical Data Series from the ICPSR includes information on the time served in office, pre and post congressional careers, and other biographical information. The data span almost the entire history of the US government, from 1789-1996. For the years 1996-2006, I use the Congressional committee membership data-sets of Charles Nelson and Charles Stewart (Nelson (1994), Stewart and Woon (2006)). Both Stewart's and the ICPSR's data-series have information about electoral success and allow me to construct a tenure variable. These data-sets contain information on committee membership, leadership positions held, and tenure in these positions. In all of these data-sets, as in the model, tenure is defined as consecutive terms in office. Such a definition is consistent with the method the House and Senate use to determine seniority.

Data on federal money allocated to each district are obtained from the Federal Assistance Awards Data System (FAADS). FAADS data records, at the transaction level, awards of federal aid to all recipients. Each transaction is identified by type (e.g. grant, loan, direct payment), the domestic assistance program it was for, and other attributes. Most importantly, it identifies the recipient at the county and district level. The Census Bureau provides FAADS data for the years 1983-2006.[7]

The federal awards in the FAADS data-set account for approximately 55% of the federal budget. Awards included in FAADS are all federal grants and other direct and indirect financial assistance to individuals, firms, and governments. Payments of wages to federal employees and procurement contracts are excluded from FAADS. The advantages of the FAADS data over the Consolidated Federal Funds Report (CFFR), which includes almost the entire federal budget, are threefold. First, the FAADS data better identifies recipient districts; CFFR data is only available at the state level. Second, FAADS awards represent true transfers, not payments for products or services. This means that we can identify the true beneficiary and the size of the benefits are clear. For example, it would be incorrect to credit Pascagoula, Mississippi

[7]For some programs, for which there are many recipients, the awards are aggregated at the county level. Most of the programs that are aggregated at the county level are non-discretionary programs that make awards to individuals according to formula, such as Social Security Retirement Insurance. Bickers and Steinand (2004) provide a version of FAADS that succeeds in allocating every transfer in FAADS to a congressional district. Through a population-based algorithm, they are able to divide the county-level aggregates into Congressional district-level aggregates. While many studies have used the data of Bickers and Steinand (2004) (Stein and Bickers (2007), Levitt and Jr. (1995), Levitt and Jr. (1997), Alvarez and Saving (1997b)), I use the Census data because the Stein and Bickers data is not correct after 1996. Since almost all of the programs that are aggregated at the county level are non-discretionary in nature, I do not believe that I suffer from using the data provided by the Census Bureau.

with the dollar value of a purchase of a battleship that was built there. Clearly Pascagoula is not the sole beneficiary from the services of the ship nor were the citizens of Pascagoula able to provide their labor at no cost. The federal assistance programs from FAADS are more pure transfers and represent public goods that are more local in nature. Third, many of the programs in the FAADS data-set are highly variable over time and across districts. Hundreds of new aid awards are realized for each district in each Congress (Stein and Bickers (2007))

Still, many programs in FAADS are not under the direct control of legislators. Programs not under the direct control of representatives include Medicare, Social Security, the Railroad Workers Pension Program, and veterans benefits programs. Programs such as these distribute aid according to a legislated formula. While Congressmen can exert influence when legislating the formula (see for example, Levitt and Jr. (1995)), once made these formula greatly limit the ability of Congressmen to direct funds to their district. A true measure of political pork must exclude such awards that Congressmen cannot directly control, thus I drop such programs from my measure of federal dollars allocated to districts. I identify such non-pork programs in the same way as Levitt and Jr. (1995) and Levitt and Jr. (1997). That is, I divide programs into high variation and low variation programs based on the coefficient of variation of each program. The coefficient of variation is taken to be the variance in mean awards by program (defined by the Catalog for Federal Domestic Assistance (CFDA) program codes) across congressional districts. The grouping puts 28 programs into the low variation group.[8] Table 1.2 lists the five largest programs in the

[8]The cutoff for the low variation programs was set to include all programs identified by Levitt

low variation group and the mean in per capita spending for each program over the sample period.[9] Low variation programs are predominately large entitlement programs and are excluded from my analysis, since these are not pork barrel programs. They are not the type of funds under the control of the legislator and thus not the funds voters consider in their evaluation of the candidate. Apparent from Table 1.2 is the difficulty in identifying pork barrel programs. While the low variation programs are determined by formula, the largest high variation program, food stamps, is also a program that is largely determined by a districts' socioeconomic characteristics and not its representative's influence. This is a shortcoming, but the low/high variation division adopted by Levitt and Snyder remains the best method of identifying those programs that allow for the most political manipulation and credit claiming.

Table 1.2: Largest High Variation Programs by CFDA Number

CFDA Code	Program Name	Mean Per Capita Outlays
10.551	Food Stamp Program	$1,534.615
20.205	Highway Planning and Construction	$1,374.487
84.01	Title I Grants to Local Educational Agencies	$482.3613
13.667	Social Services Block Grant	$353.0026
93.784	Federal Reimbursement of Emergency Health Services	$252.0816

The majority of dollars in aid handed out by the federal government in each year are payments for grants and assistance awards that originated in previous years, which presents a problem when attempting to identify the outlays a politician can

and Jr. (1995) as low-variation programs into the low-variation group in my sample. The coefficient of variation that I use as a cutoff is 1.283, as opposed to 0.67 from Levitt and Jr. (1995). They include 16 programs in their low-CV-group, I include 28 in mine. A full list of the programs in the low variation group is provided in the appendix Table A.1. Moving this cutoff around does not change the results in any significant way.

[9]Dollar values here and throughout are all in constant 2006 dollars.

claim credit for. The results in this study use only new payments (and not continuing payments) for high variation programs.

After restricting my funds data to new, high variation programs reported in FAADS, I am left with approximately 5.5% of the federal budget or about $60 billion per year. The average amount of federal spending per capita, per term using my definition of newly awarded discretionary funds is $552.53 and varies greatly across districts over the sample. The lowest spending in a district is $0.06 per capita in Florida's 22nd district during the 107th Congress, and the district with the most discretionary spending is New York's 21st district, with $24,286.33 per capita during the 108th Congress. The standard deviation in per capita spending on high variation programs in $1,676.09.

1.3 Estimation Strategy

Estimation takes place in two stages. I estimate the relationship between seniority and the ability to direct funds, the relationship between seniority and non-electoral exit from office, and the relationship between seniority and committee assignments in a first stage, outside the structural model. With these estimates and a value for the time preference parameter, I then estimate the final three parameters of the model, those governing the stochastic processes for candidate quality, using the structural model and an indirect inference approach as in McFadden (1989).

1.3.1 Stage 1

In the first stage, I estimate $\alpha_1, \alpha_2, \alpha_3, \sigma_\epsilon$, the parameters of the function describing the relationship between seniority and federal discretionary spending. and the probabilities of non-electoral exit from office, $\delta(T_H)$. For the committee model, I also estimate α_4, the coefficient on the committee indicator variable; $\pi_c(T_H)$, the probabilities of obtaining a seat on a powerful committee, and $\pi_{cc}(T_C)$, the probabilities of retaining a seat on a prestigious committee. As discussed previously, T_H represents tenure in the House and T_C tenure on a prestigious committee.

Regression analysis identifies $\alpha_2, \alpha_3, \alpha_4$, and σ_ϵ. Equation 1.13 describes the model of the seniority-funds relationship estimated for the naïve model and Equation 1.14 describes the committee model's seniority-funds relationship. Again, $T_{i,t}$ is tenure in the House in the naïve model and tenure on a prestigious committee in the committee model.

$$f_{i,t} = d_i + \alpha_2 T_{i,t} + \alpha_3 T_{i,t}^2 + \gamma_1' P_{i,t} + sc_{i,t} + \epsilon_{i,t} \tag{1.13}$$

$$f_{i,t} = d_i + \alpha_2 T_{i,t} + \alpha_3 T_{i,t}^2 + \alpha_4 comm_{i,t} + \gamma_1' P_{i,t} + sc_{i,t} + \epsilon_{i,t} \tag{1.14}$$

The parameter α_2 is the coefficient on a representative's tenure (or committee tenure) from a regression of tenure and other controls on per capita federal outlays and α_3 is the coefficient on the square of tenure. The parameter α_4 is the coefficient on the committee membership dummy variable in the committee model. Each model includes a district specific fixed effect, d_i a set of political controls, $P_{i,t}$ and dummy variables

for the interaction of the state and congressional term, $sc_{i,t}$. The political control variables include the fraction of the vote the representative won the last election with (a proxy for the security of the incumbent's seat), the money received from PACs during the last election cycle, and the political party affiliation of the representative. In the naïve model, the political controls also include dummy variables indicating membership on standing committees. District fixed effects account for heterogeneity across districts, which affect the amount of spending that is directed towards the district. Including the state-congress interaction accounts for transitory, statewide increases in spending. The stochastic portion of funds, σ_ϵ is the unexplained variation in per capita funds from the regressions. The intercept on the funds production function, α_1, I estimate as the average per capita funds of districts with freshman Representatives or as the average funds of a district with a Representative who does not sit on a prestigious committee, depending upon the model.

The time preference parameter, β, is set to 0.9 which, since a model period is a two-year term in the House, corresponds to an annual risk free interest rate of about 5%. I estimate the δ_T's using the empirical probability of retirement conditional on tenure from the sample.[10] Similarly, I estimate the transition matrix for committee seats conditional on seniority in the House (for the probability a representative attains a seat) or conditional on seniority on a committee (for the probability a representative retains a seat) using the empirical probabilities of such transitions from the data.

[10]The assumption of exogenous probabilities of non-electoral exit is consistent with the evidence of Ansolabehere and Jr. (2004) who find no evidence that candidates for statewide office retire strategically. Gowrisankaran, Mitchell, and Moro (2008) also make the assumption that Congressmen's retirement probabilities are non-strategic.

1.3.2 Stage 2

1.3.2.1 Structural Estimation

After the first stage estimation, the parameters governing the distributions of incumbent and challenger quality (ρ, μ, σ_η, and σ_u) must be estimated. One cannot identify μ because the voter has no outside option and because the decision rules are the same under any affine transformation of the utility function. There must be *some* representative in office and therefore one cannot identify the mean of the distribution of candidate quality, but only the differences between candidates. I set $\mu = 0$ as a normalization. Measures of candidate quality are interpreted as differences in quality between the candidate elected and the best challenger. The remaining three parameters are estimated via indirect inference in the second stage. Table 1.3 summarizes these parameters.

Table 1.3: Parameters Estimated via Indirect Inference

Parameter	Definition
ρ	persistence of candidate quality
σ_u	std dev of shock to incumbent quality
σ_η	std dev of new candidate quality

The parameters $\Theta = (\rho, \sigma_\eta, \sigma_u)$ are estimated using a simulated method of moments (SMM) approach as described in McFadden (1989). The use of SMM over alternative methods, such as maximum likelihood, for several two reasons. First, SMM is transparent. The moments are clearly defined, well measured, and easily interpreted. Second, maximum likelihood is more computationally burdensome. Models with persistent, but not permanent, unobserved heterogeneity, present a real

challenge to computational methods.[11]

SMM estimation have the following algorithm. Given the results of the first stage estimation and a vector Θ, the dynamic programming problem (DPP) of the voters is solved. The solution to the DPP is a set of policy functions determining the voter's optimal choice of candidate given the quality of both candidates and the seniority of the incumbent. The policy functions are used to simulate a panel of House elections. From the simulated panel, I calculate a set of moments. Call the vector of simulated moments $\Psi^s(\Theta)$.

The estimate, $\hat{\Theta}$, is the vector of parameters that minimizes the weighted distance between $\Psi^s(\Theta)$ and the vector of moments from the data, Ψ^d. Formally, $\hat{\Theta}$ solves:

$$\pounds(\Theta) = min_{\Theta}[\Psi^d - \Psi^s(\Theta)]'W[\Psi^d - \Psi^s(\Theta)] \tag{1.15}$$

Where W is the optimal weighting matrix , calculated as the inverse of the variance-covariance matrix of the moments, following Gourieroux, Monfort, and Renault (1993). The variance-covariance matrix is found by bootstrapping the moments from the data. Using the SMM procedure with the optimal weighting matrix ensures consistent and efficient estimates of Θ.[12]

[11] Arcidiacono and Miller (2008) have recently developed a feasible way to estimate such models, but one cannot apply their methods to the current model if the retirement probabilities depend upon tenure. Such dependence is important in the data and thus for calculating effects of policies on candidate quality.

[12] For further details regarding the the solution to the model and the estimation procedure, please see Appendix section A.1.

1.3.2.2 Moments and Identification

Identification of the three parameters, $\rho, \sigma_u, \sigma_\eta$, governing the unobserved candidate quality in the naïve model is achieved by use of the following moments: the mean number of terms of tenure in the House, the ratio of mean to median tenure in the House, the probability that an incumbent wins his next election conditional on running, and the coefficient on tenure from a probit of winning on tenure.[13] The parameters describing the spreads of the distributions, σ_u and σ_η, affect the arrival rate of winners and the differences in quality between winners and runners up in the elections. Mean tenure and the incumbent re-election rates are the largest contributors to pinning down these two parameters. The probit goes the furthest in identifying the persistence of the incumbents' quality. The mean to median ratio is a measure of the skewness of the distribution, which helps identify each parameter, to some extent. Using an additional moment allows me to conduct an over-identification test of the model. Table 1.3 summarizes the parameters I estimate by indirect inference. Table 2.4 summarizes the moments used for estimation of the naïve seniority model.

Estimates of the parameters from the committee model are found in the same way, but the moments change because of the highlighted role of committees. The moments I use to estimate the three parameters from the quality processes in the

[13]The probit from the data controls for many political and socioeconomic variables that might affect a candidate's electoral success. When running the probit on the simulated data the only state variable other than quality (which is not observed in the data), is seniority. Thus the probit on the simulated data is run only on a constant and seniority. The coefficient on tenure from the probit run on the simulated data corresponds to the coefficient on tenure from the probit using the data when I capture the true effect of seniority on the probability of winning by controlling for other observables. Results of the probits are reported in Table A.2 in the Appendix.

Table 1.4: Moments for Naïve Seniority Model

Moment	Value	Std Error
Mean Tenure	4.826	(0.052)
Mean/Median Tenure	1.207	(0.017)
Inc Reelect Rate	0.957	(0.003)
Probit(win|tenure)	0.018	(0.013)

committee model are the mean number of terms of tenure on the prestigious committees, the ratio of mean to median tenure on these committees, the fraction of committee members that win re-election (conditional on running), the coefficient on committee tenure from a probit of winning on tenure, and the fraction of the House that has a seat on a prestigious committee. Table 1.5 presents the moments for estimation of the committee seniority. One can see a similar relationship between the moments and the identification of the parameters as described in the naïve case. The moment, unique to this case, describing the fraction of House members on a committee is added since, although the committee assignment process is exogenous, the voters have the ability to control the number of committee members by re-electing those that attain committee seats at higher rates. This moment, along with the moment that is the fraction of committee members winning re-election, helps to identify the variance parameters.

Table 1.5: Moments for Committee Seniority Model

Moment	Value	Std Error
Mean Tenure	4.421	(0.069)
Mean/Median Tenure	1.474	(0.106)
Comm Reelect Rate	0.961	(0.004)
Probit(win|tenure)	0.021	(0.019)
Frac on Comm	0.497	(0.007)

1.4 Results

I now present and discuss the results from both stages of estimation. The following subsection includes the results from the first-stage estimation, for both the naïve and committee seniority models. I then move on to separate discussions of the results from the structural estimation of each of the models.

1.4.1 First Stage Estimation Results

The exogenous probabilities of retirement from office are summarized in the first row of Table 1.6. The values range from 0.041 to 0.222, taking on the lowest value in the first term, but not monotonically increasing in tenure.[14] It does appear that tenure is a slightly better proxy for retirement decisions than is age. The correlation between retirement and tenure is 0.13 and the correlation between retirement and age is 0.10. One might expect tenure to have a higher correlation with retirement decisions and for the retirement probabilities to be non-monotonic because the House is often a platform from which higher office is sought. That is, representatives leave the House after gaining some amount of political experience, not when they wish to end their careers.

Table 1.6: Parameters

Parameter	Definition	Value
δ_{T_H}	prob. of retirement	0.041-0.222
$\pi_c(T_H)$	prob of obtaining a committee seat	0.037-0.415
$\pi_{cc}(T_C)$	prob of retaining a committee seat	0.839-1.000

[14]Retirement probabilities for each level of seniority are reported in Table A.3 in the appendix.

Rows 2 and 3 of Table 1.6 summarize the exogenous committee assignment process. The probabilities indicate the likelihood (conditional on tenure in the House and tenure on a committee) that a Representative is assigned to one of the five committees identified as having a strong influence on discretionary spending; Ways and Means, Armed Services, Appropriations, Small Business, Natural Resources. As with the retirement probabilities, these probabilities are not monotonic in seniority. In fact, the probability of attaining a seat on a prestigious committee is highest in a representative's freshman term.[15]

Table 1.7 presents the estimates of α_2, α_3, and α_4 the returns to seniority at the pork barrel. The first column is the naïve seniority model and the second column is the model of committee seniority. In both cases I report only the coefficients on a subset of the political control variables.[16] For the naïve seniority regression model, I include indicator variables for specific committee assignments. In both models, I include district fixed effects and include dummy variables for each state and congress interaction. The specification for the naïve seniority regression model similar to the specification in Alvarez and Saving (1997a) who perform the analysis on the 101st Congress. As in Alvarez and Saving (1997a), I find a similarly small effect of seniority in the House on outlays with an estimate of just over $2 per capita as the marginal impact of another term of tenure on federal outlays and a t-statistic that is not significant at any reasonable level. Seniority on a prestigious committee (Ways and Means, Armed Services, Appropriations, Small Business, Natural Resources) does

[15]The complete set of probabilities of obtaining and retaining seats on the prestigious committees are reported in Table A.4 and Table A.5.

[16]For the results reported in full, please see Table A.6 and Table A.7 in the Appendix.

Table 1.7: Outlays/Tenure Regressions

Dependent Variable:	New Outlays, High Variation Programs	
Model:	Naïve	Committee
Tenure	2.235	
	(14.708)	
$Tenure^2$	0.137	
	(1.040)	
Power Comm Tenure		59.249***
		(19.505)
$PowerCommTenure^2$		-3.866**
		(1.522)
Power Comm Member		-60.605
		(48.605)
Gen Elec Pct	0.065	1.071
	(1.606)	(1.586)
PAC Contrib	0.001***	0.001***
	(0.000)	(0.000)
Democrat	40.260	37.669
	(50.232)	(49.181)
Controlling Party	8.841	9.856
	(32.217)	(31.873)
District Fixed Effects	Yes	Yes
State*Congress Controls	Yes	Yes
R-Squared	0.903	0.903
Observations	5216	5216

have an economically and statistically significant coefficient. The average return to a term on one of these committees is \$59.24 per capita. The estimate of α_4, the coefficient on the indicator of committee membership on a powerful committee, is negative, but is not statistically significant.[17]

In the naïve model, the parameter α_1 is set to the mean funds for a district

[17]I have tried including a dummy for committee chairmanships, but the coefficient is insignificant and negative in any reasonable specification. This is not an intuitive result and could be the result of the limited sample period and the long periods of time these chairmanships are held for. As a result, I have excluded chairmanship positions from the model.

with a freshman Representative. In the committee model, α_1 is equal to the mean funds for a district who's Representative does not sit on a prestigious committee. The point estimate of α_1 is \$463.314 in the naïve model and \$399.846 in the committee model. The unexplained variation in per capita outlays from the regressions in Table 1.7 is σ_ϵ and equals \$484.723 in the naïve model and \$484.878 in the committee model.

I also estimate a model that is most favorable to the story of a costly seniority trap. The estimates of the returns to tenure of Falk (2005) are the largest in the literature. These estimates should result in the largest inefficiencies resulting from the seniority system. I calibrate the funds production function of the naïve seniority model to the returns to tenure documented by Falk. That is, I set α_1 to \$17,875.13, α_2 to \$802.75, and α_3 to 0. The parameter σ_ϵ is not available in Falk's paper, but is set to \$484.723, the same as in the naïve model. Although this value is not given by Falk, and may differ for his models, the value has no effect on the results given the risk neutrality of the voters.

Falk's numbers differ substantially from mine and those of others for two reasons. First, Falk uses a broader definition of pork barrel spending, which includes almost the entire federal budget. This mean that spending on military equipment and salaries of federal employees are included in the expenditures he considers. Both of these categories of federal spending are occasionally mentioned in regard to pork barrel spending. Second, Falk uses regression discontinuity approach to find exogenous variation in seniority in order to find an unbiased measure of the effect of seniority on federal outlays.[18]

[18]Falk argues that the measured returns to seniority found by others are biased downward for two

Table 1.8 summarizes the parameters used in the funds production function in all models, using both my estimates and the values estimated by Falk (2005).

Table 1.8: Parameters of the Funds Production Function

Parameter	Naïve Model	Committee Model	Falk Calibration
α_1	463.314	21.473	17875.131
α_2	1.951	60.077	802.747
α_3	0.128	-3.930	0.000
α_4	N/A	-54.661	N/A
σ_ϵ	484.723	484.878	484.723

For each the naïve model, the committee model, and the model calibrated to Falk (2005), I now present the parameter estimates for the parameters in the vector Θ and the moments from the data and estimated models. I begin with the naïve seniority model.

1.4.2 Naïve Seniority

Table 1.9 presents the estimates for the parameters describing the distribution of candidate quality in the model of naïve seniority. Standard errors are reported

reasons. As found by Tufte (1975) and Erikson (1990), incumbent re-election rates are sensitive to the state of the economy. Because some spending programs are determined by formula, these programs may increase in size during times of economics distress. As Falk points out, these are precisely the times when one is more likely to see an incumbent Representative fail to win re-election and a freshman take office. Such an interaction leads to a downward bias on the measured effect of seniority on funds because spending has increased when a freshman takes office, for reasons unrelated to his ability to procure funds. This argument motivates Levitt and Jr. (1995) to distinguish high and low variation programs and Stein and Bickers (2007) to separate discretionary from non-discretionary spending. In addition, Falk argues that senior incumbents may put forth little effort to direct spending towards their district because they are secure in their seats. Omitting the effort level of politicians from the regressions leads to a downward bias on the returns to seniority. To control for this omitted variable bias, I include the incumbent's vote share for the election from which he last won office. This variable is a proxy for the security of the Representative's seat and should be correlated with his effort level.

in parentheses under the parameter estimates. All parameters are well identified, as evidenced by the small standard errors. It is difficult to interpret the parameter estimates and their implications for the quality of representatives in office at this point. One can see that the quality of incumbents exhibits a great deal of persistence, but its difficult to determine the effect of the parameter value on the quality of officeholders.

Table 1.9: Naïve Seniority Model Parameter Estimates

Parameter	Estimate
ρ	1.000
	(0.000)
σ_u	17.818
	(3.267)
σ_η	84.845
	(11.561)

Table 1.10 displays the moments from the model and data. The model does well matching the moments. It almost exactly matches the mean tenure and the mean to median ratio for tenure. The model does less well in its attempt to match the re-election rates of incumbents and the coefficient from the probit, but is still quite close.[19] It is difficult to match both the low coefficient on the probit and the high rates of re-election. There are small returns to tenure at the pork barrel, but the selection effects are strong. More senior Congressmen are on average, of higher

[19]I try to match four moments from the data using three parameters, which allows me to conduct the over-identification test of the model that Hansen and Singleton (1982) propose. Since I try to match one more moment than the number of parameters I estimate, the J-statistic is distributed $\chi^2(1)$ and the value of 593.228 rejects the model at traditional significance levels. The power of this test is low, and most structural models are rejected. I report the J-stat because while the model fails the test, the J-statistic is useful for comparing the fit of the three models presented.

quality and this drives of the coefficient from the probit in the model.

Table 1.10: Naïve Seniority Model Moments

Moment	Model Value	Data Value
Mean Tenure	4.876	4.826
Mean/Median Tenure	1.219	1.207
Inc Reelect Rate	0.882	0.957
Probit(win|tenure)	0.084	0.018
J-Statistic	593.228	-

1.4.3 Committee Seniority

Parameter estimates for the model of committee seniority, and their associated standard errors, are presented in Table 1.11. The committee model displays a smaller degree of persistence of the incumbents' quality and larger variances for both distributions. The estimates of the variances of the quality distributions for the committee model are larger because the returns to seniority in terms of federal outlays are larger in the committee model. This means the tenure effect is stronger. To match the small coefficient on tenure from the probit, the tenure effect cannot be the driving force in re-election probabilities. Thus the spread of the quality distributions increases and the selection effect becomes relatively stronger. The parameters are all well identified as one can observe in the standard errors that are reported in parentheses under the parameter estimates. Overall the model fits the data well and the J-statistic of 32.994 is much lower than that from the naïve model.

Table 1.12 presents the moments from the model and data. Note, that tenure in this model is not tenure in the House, but tenure on one of the five power committees: Ways and Means, Armed Services, Appropriations, Small Business, and Natural

Table 1.11: Committee Seniority Model Parameter Estimates

Parameter	Estimate
ρ	0.997
	(0.000)
σ_u	157.552
	(34.522)
σ_η	281.055
	(45.868)

Table 1.12: Committee Seniority Model Moments

Moment	Model Value	Data Value
Mean Tenure	4.427	4.421
Mean/Median Tenure	1.476	1.474
Comm Reelect Rate	0.848	0.961
Probit(win|tenure)	0.026	0.021
Frac on Comm	0.477	0.497
J-Statistic	32.994	-

Resources. The two moments I match most closely are again those which describe the distribution of tenure. Other moments from the model are still very close to their counterparts from the data.[20] Note that it is difficult to simultaneously match the moments on re-election rates and the low coefficient on tenure from the probit. The decision rules of agents in this model, given the estimated parameters, depend very little on tenure *per se*. That is, voters are almost solely electing candidates based on quality. Yet this creates a selection effect that drives up the coefficient on tenure in the probit. The difficulty of matching both moments increases as the spreads of the quality distributions increase. While the committee model is able to closely replicate the probit results, it does less well matching the incumbents' re-election rates.

[20]Again in this case, the J-statistic (distributed here as $\chi^2(2)$) of 32.994 rejects the model, but the model does quite well in having a J-statistic this low.

1.4.4 Calibration Based on Falk

The Falk calibration uses the same model and the same moments as the naïve seniority case. The difference between the two is in the funds production function. I estimate the return to a term of seniority at just over $2 per capita. Falk (2005) uses a more sophisticated econometric technique and a more comprehensive measure of federal outlays and finds much larger returns to seniority.

Falk uses a regression discontinuity approach, using exogenous variation in tenure that is provided by redistricting. The exogenous variation provides Falk with an unbiased estimate of the returns to tenure in terms of federal outlays. He also includes spending not in FAADS such as wages of federal employees and government procurement contracts. The drawback to Falk's analysis is that tenure is measured at the state level. This makes interpretation of the returns to tenure difficult since most states have more than one representative. I thus take Falk's estimate for the returns to tenure for a representative from a state-wide district, which is $802.747 per capita for an additional term of tenure. This estimate is much larger than mine and most others' estimates for the econometric reasons cited and because Falk uses a much larger measure of funds; almost the entire federal budget compared to my use of 5.5% of the federal budget. I use Falk's estimates as a kind of robustness check. If I find that the costs of the seniority trap to be small, it may be due to my estimates of the returns to seniority. To give the seniority trap story the best possible chance, I use Falk's estimates of the returns to tenure.

Table 1.13 presents the parameter estimates for the calibration based on Falk (2005). The AR(1) process is found to have slightly less persistence than even the

Table 1.13: Parameters from Calibration Based on Falk

Parameter	Estimate
ρ	0.994
	(0.001)
σ_u	497.729
	(83.079)
σ_η	407,363.805
	(27,194.191)

committee model. The variance parameters are very large due to the large returns to tenure that Falk measures.

Table 1.14: Moments from Calibration Based on Falk

Moment	Model Value	Data Value
Mean Tenure	5.026	4.826
Mean/Median Tenure	1.256	1.207
Inc Reelect Rate	0.862	0.957
Probit(win|tenure)	0.184	0.018
J-Statistic	1,145.600	-

Table 1.14 presents the moments from the data and the model. The moments from the Falk calibration are close to those from the data, but the fit of this model is not as good as either of the other two models.[21] One can see the difficulty in matching the coefficient from the probit when the spreads from the quality distributions increase. The quality of candidates in office is highest in this model and the selection effect the strongest.

[21]The J-statistic here is 1,145.600, much higher than in the other models, suggesting that this model is an ever poorer model of the Congressional election process.

1.5 Policy Experiments

Using the estimated models, I conduct three policy experiments: reform of the seniority system, term limitations, and a tax on seniority. For each model, I calculate the average quality of officeholders under the baseline case and for each of the policy changes.

Two important points must be made here. Under the assumptions of the model (quality and funds are perfect substitutes, voters are risk neutral, and the size of the pork barrel is fixed) and with a social welfare function that is utilitarian over the utility of the decisive voters, one can interpret changes in office holder quality as changes in voter welfare.[22] Second, the mean of the quality distribution cannot be identified and is normalized to zero. This means that candidate quality, as I measure it, is to be interpreted as an equivalent variation measure. It is the value, in dollars of discretionary spending, that the decisive voter would pay in order to have the winner in office instead of the next best challenger.

Keeping the two caveats above in mind, I proceed with the policy experiments, interpreting changes in quality as changes in welfare. I begin with a reformation of the seniority system.

[22]The idea of using only the utility of the decisive voters in the social welfare calculation, as opposed to the welfare of all voters or all citizens, is done for two reasons. First, it is difficult to measure the welfare of all voters given the methods I used to uncover voter preferences. My methods rely on the voter casting the pivotal vote. Second, such a welfare function is, in a sense, implicit in the social choice function laid out in the U.S. Constitution.

1.5.1 Seniority System Reform

The seniority system in the U.S. Congress is not the result of legislation, but is a *de facto* rule followed by its members.[23] Furthermore, not all of the benefits of seniority come from the seniority system; undoubtedly learning occurs that increases a Congressman's ability at the pork barrel as he gains experience. Thus, it might be very difficult to legislate away the seniority trap. Still, I implement a policy of seniority system reform that takes away all of the advantages in obtaining federal outlays that are due to seniority. More formally, I set $\alpha_2 = \alpha_3 = 0$ in all the models. While such a policy might not be realistic, it illustrates the largest possible costs of the seniority trap.

Table 1.15 summarizes the results of seniority system reform. The second column presents candidate quality before reform, the third column presents candidate quality after reform, and the fourth column is the difference between the reform and the baseline case. Rows of the table represents the different models: The results from the naïve model are first row, the results from the committee model are second, and the results from the Falk calibration are last row. Standard errors from 500 Monte Carlo simulations of the model are reported in parentheses under the estimates of quality. The Monte Carlo simulations account for uncertainty in the draws of candidate quality and for uncertainty about the parameter estimates. Before reform of the seniority system, the decisive voters in the naïve model would give up \$123.34 in federal outlays, on average, to have in office those candidates who won election

[23] See McKelvey and Riezman (1992) for a model where a seniority system is endogenous and self-sustaining.

as opposed to the next best challenger. Under the reform, this measure of quality increases just over $3 in the naïve model. That is, the average decisive voter would give up about $3 per term in discretionary spending to reform the seniority system. The reform increases the average quality of an officeholder in the other two models also. Both experience larger gains than the naïve model because they have larger returns to tenure in terms of federal outlays. The maximum gain from reforming the seniority system is $578.21, from the Falk calibration. The Falk calibration also has the largest standard errors on mean quality, however one can reject the hypothesis that mean quality is the same in any two of the models at the 5% significance level.

Table 1.15: Seniority System Reform

Model	Baseline	No Seniority Effects	Difference
Naïve	$123.346	$126.379	+$3.033
	(35.338)	(34.876)	(13.056)
Committee	$429.975	$465.044	+$35.069
	(67.451)	(65.256)	(21.679)
Falk	$5,430.613	$6,008.822	+$578.209
	(1,271.671)	(1,222.337)	(426.981)

Such a reform must have a positive effect on quality since the returns to tenure are greater than zero and voters gain utility from federal outlays. However, the returns to tenure are quite small in comparison to the differences in candidate quality. Despite the large returns to seniority measured by Falk, if one wishes to construct a model that matches the characteristics of Congressional elections, (and, in particular, the small change in the re-election rates of incumbents as their seniority increases) then the quality of candidates must become much larger. The models display a positive correlation between outlays and the probability of re-election, but such a correlation

is largely due to a positive selection bias, even with the tenure effects found by Falk. More senior representatives are, on average, of higher quality than more junior representatives due to selection effects, and thus are more likely to win re-election. A positive correlation between funds and winning is largely due to the fact that both funds and quality increase with tenure.

1.5.2 Term Limits

Term limits are the most commonly cited solution to the seniority trap. Academics who analyze the role of term limits in this context include Dick and Lott (1993), Elhauge, Lott, and Manning (1997), Mao (2001), and Bernhardt, Dubey, and Hughson (2004). Term limits were also a major part of the Republicans' "Contract with America" and Congressional term limits were passed by referenda in several states before being struck down by the Supreme Court in *U.S. Term Limits, Inc. v. Thornton*. While House Joint Resolution 38, a part of the "Contract", failed to leave the House, using the model in this paper I calculate what might have happened to the quality of office holders had it been implemented. H. J. Res 38 proposed a six-term term limit on representatives, the length of which I follow in my policy experiment.

Term limits can affect voters' choices between incumbents and challengers in two ways. By forcing out more senior members, the voters face a smaller tradeoff between electing a challenger as opposed to an incumbent. That is, even if the returns to seniority are the same, the incentive to re-elect an incumbent is smaller because he is forced out of office after a specified period of time. Term limits will also affect the decisions of voters by changing the returns to seniority. A change in

the distribution of tenure, caused by term limits, will affect the allocation of power with give by the seniority system. I present the upper bound on the benefits that term limits might confer. That is, term limits in this experiment completely reform the seniority system, making the incentive to re-elect incumbents as low as possible. Notice that term limits can only be a net loss if no seniority trap exists. They may have a positive benefit in as much as they reduce the wedge between incumbents and challengers that results from pork barrel politics.

Table 1.16 follows the format of the previous section and presents the results of the institution of term limits, with Monte Carlo standard errors reported in parentheses. In all cases, term limits have a negative effect on office holder quality. In the naïve model, the drop in the quality of officeholders is dramatic, from \$123.67 to \$100.84.[24] Although the Falk calibration presents the strongest case for term limits because of the large amount of pork senior members can direct to their district, it also has the largest losses under term limits of the three models due to the high measure of quality for those who hold office. In the language of Gowrisankaran, Mitchell, and Moro (2008), one can see that the selection effect (quality) is much stronger than the tenure effect (pork provision). Term limits may be able to improve voter welfare, as Bernhardt, Dubey, and Hughson (2004) and others argue, but empirically term limits are harmful to voter welfare.

Another reform in the "Contract with America" is the term limitation of com-

[24]More strict term limits decrease welfare further. A two term term limit results in officeholder quality that is \$61 below the baseline case in the naïve model, \$243 lower in the committee model, and \$3,573 lower in the Falk calibration.

Table 1.16: Welfare Under Term Limits

Model	Baseline	Term Limits	Difference
Naïve	\$123.346	\$100.848	-\$22.498
	(35.338)	(34.099)	(13.278)
Committee	\$429.975	\$304.704	-\$125.271
	(67.451)	(47.969)	(30.436)
Falk	\$5,430.613	\$5,272.091	-\$158.522
	(1,271.671)	(1,071.733)	(420.779)

mittee seats. Given the returns to seniority on committees, such term limits provide an alternative to term limits on House seats. Committee term limits allow high quality members to stay in Congress, but limit membership on committees, where I find the largest returns to seniority. Instituting term limits on committee membership in the committee model results in an average level of office-holder quality that is between the baseline case and the case of complete reform of the seniority system. The extent to which the result approaches the value found under reform of the seniority system depends upon how committee term limits affect the seniority system within committees and thus the returns to committee seniority.

1.5.3 Seniority Tax

While the quantity constraint that is term limitation has been popular, a policy change that affects the relative prices is more efficient, if not politically viable. If one were serious about reducing the costs of the seniority trap identified in section 5.1, a tax can be used to eliminate the wedge between incumbents and challengers that results from the pork barrel. A tax has the advantage of reducing the distortion while allowing high quality and low quality Representatives to stay in office.

To achieve the first-best solution, I institute a seniority tax.[25] The size of the tax is a function of the incumbent's tenure. A district is taxed, in federal outlays, for electing an incumbent. Formally:

$$u(f(T_{i,t}, \epsilon_{i,t}), \eta_{i,t}) = f(T_{i,t}, \epsilon_{i,t}) - \tau(T_{i,t}) + \eta_{i,t} \tag{1.16}$$

Where $\tau(T_{i,t})$ is the seniority tax and is optimally set when $\tau(T_{i,t}) = \alpha_2 * T_{i,t} + \alpha_3 * T_{i,t}^2$. Such a tax can completely eliminate the wedge between incumbents and challengers and does not have the costs of term limits since it allows quality incumbents to remain in office. Table 1.17 presents the results of the seniority tax experiment, with Monte Carlo standard errors in parentheses below the estimate of the average quality of office holders. These results are equivalent to the reform of the seniority system; an optimally set seniority tax achieves the first-best outcome.

Table 1.17: Welfare Under Seniority Tax

Model	Baseline	Tax	Difference
Naïve	\$123.346	\$126.379	-\$3.033
	(35.338)	(34.876)	(13.278)
Committee	\$429.975	\$465.044	-\$35.069
	(67.451)	(66.511)	(22.390)
Falk	\$5430.613	\$6008.822	-\$578.209
	(1271.671)	(1222.337)	(420.779)

[25] While the specifics of how such a tax might be implemented are beyond the scope of this paper, one can think of such a tax as a "negative earmark".

1.6 Discussion

After presenting the results from the policy experiments it is useful to discuss how alternative assumptions would affect the results. Although the model presented is true to the models of those who have argued that the seniority trap is economically significant, it is important to discuss how changes to the model might affect the conclusions we reach.

The literature on the incumbency advantage often cites the importance of the ability of incumbents to deter high quality challengers (Levitt and Wolfram (1997)). This role of incumbency is at the heart of the dynamic selection model of Gowrisankaran, Mitchell, and Moro (2008). An obvious effect of lower quality challengers in contested elections is term limits becoming more attractive when one is considering the effects of policy on voter welfare. As Gowrisankaran, Mitchell, and Moro (2008) find, if the "scare-off" effect is large enough, term limits may even increase voter welfare. Assuming away the scare-off effect of incumbency means that I overestimate the costs of term limits. While this may be a drawback of the model, Cox and Katz (1996) find most of the incumbency advantage can be attributed to the quality of incumbents with only about one-tenth of the incumbency advantage resulting from the scare-off effect. Their results suggest that my model captures the quantitatively important effects.

Furthermore, Merlo, Diermeier, and Keane (2005) find that term limits lower the value of a seat in the House. To the extent that ability in the legislature and in the other sectors are correlated, a lower value to a seat in the House means that more high ability candidates will seek employment elsewhere. Omitting the candidate

selection process from my model will then result in an underestimate of the costs of term limits.

Beyond the effects on the quality of challengers, term limits have effects on how well incumbents serve their constituents. Most notably, my model does not account for political agency problems. Term limits create lame ducks and, as Smart and Sturm (2004) show, term limits may lower the value of incumbents when agency problems exist. Ignoring lame duck issues results in my underestimating the costs of term limits.

District preferences for pork may vary. Because I measure quality in terms of the value of pork, and because I assume that pork is valued similarly across districts, the effect of ignoring heterogeneity in the preference for pork is to overestimate the quality of candidates in districts with a below average preference for pork and to underestimate the quality of candidates in districts with an above average preference for pork. Given the risk neutrality of voters in the model, the effects average out, and I have an accurate measure of the average quality of candidates.

Adding risk aversion to the model has a number of effects. Holding constant the parameters governing the distributions of candidate quality, increases in the risk aversion of voters increase the re-election rates of incumbents. The increase in re-election rates is due to the increase in the option value of an incumbent. To match the moments from the data, and the incumbency re-election rates in particular, the estimates of the quality of candidates in office would decrease. The result, on the measures of voter welfare, would be a lower cost of the seniority trap and a lower cost to instituting term limits.

1.7 Conclusion

Worry over the seniority trap appears largely exaggerated. I have constructed a model that provides an environment where the effects of seniority and pork barrel politics would have their largest impact. I have also used the largest estimate of the returns to seniority found in the literature. Only when the returns to seniority are extremely large, does one find an economically significant change in representative quality due to the incentive to re-elect incumbents in order to direct funds to the district. In all cases, the oft-cited cure is worse than the disease; term limits have a negative net impact on candidate quality. Moreover, in the case where term limits have the largest potential benefit, they are found to have the largest costs. For those that continue to believe the seniority trap carries large costs, their solution must not ignore the benefits to keeping quality candidates in office.

My results suggest two policies that dominate term limits on House representatives. The first is to not place term limits on House membership, but on committee membership. Committee assignments drive the relationship between seniority and spending. By limiting the time a representative can sit on a committee, one reduces the distortion of pork barrel politics while allowing quality candidates to remain in office. Such a policy, in addition to term limits on terms in the House, was a part of the "Contract with America". Neither measure was passed into law. A more unique solution is the seniority tax proposed in Section 5.3. Such a tax, set optimally, would completely eliminate the wedge between incumbents and challengers that results from pork barrel politics and allow candidates to remain in office indefinitely.

Several avenues for future research present themselves. Endogenizing the

choices of politicians is an obvious path. Daniel and Jr. (1997) find that term limits have indirect effects on campaign outcomes through campaign finance and candidate reputation. Besley and Case (1995) find important effects on policy due to lame duck politicians, which are ignored in my analysis. Levitt and Wolfram (1997) cites the importance of endogenous challenger selection to the outcomes of Congressional elections. Such sources, among others, point to the importance of modeling the decisions of members of Congress.

A second line of research is to conduct a more thorough analysis of the relationship between committee seniority and the ability to direct federal spending. From the results of this paper, such a relationship appears strong, but the political science and economics literatures contain little corroborating evidence.

Chapter 2

Flip-Flopping: Ideological Adjustment Costs in the United States Senate

Models of electoral competition often follow Downs (1957) and allow candidates to freely adjust their positions in the issue space to capture the majority of voters. The result, in a two-candidate election with a single dimensional policy space and single peaked preferences, is both candidates adopting the position of the median voter. Such convergence is rarely observed and is potentially at odds with the party polarization cited by the media and academics (e.g. Poole and Rosenthal (1991)). A possible source of the non-convergence of positions is candidate reputation (see, for example, Bernhardt and Ingberman (1985), Enelow and Munger (1993), and Kartik and McAfee (2007)). That is, candidates may find it costly to change positions in the issue space because it affects the voters perceptions of the candidates credibility or character. Indeed, recent presidential hopefuls John Kerry and Mitt Romney can attest to the electoral costs of changing positions to attract voters.

The following study analyzes the nature of the electoral costs Senators face when adjusting their ideological position. Using over 50 years of roll call voting scores from the United States Senate, I estimate the structural parameters of a dynamic model of candidate positioning. Using a simulated method of moments (SMM)

methodology, I am able to identify the nature of ideological adjustment costs in the U.S. Senate.

Understanding the electoral cost associated with a candidates change in position is important for a number of reasons. First, by finding large costs to adjusting position, one calls into question the empirical validity of the median voter model and the policy predictions based upon it. Second, knowing the nature of these costs is important for understanding the role of candidate credibility and reputation in electoral outcomes. For example, if the costs Senators face are non-convex in nature, we would expect to see "flip-flopping" Senators. That is, Senators who hold a position for long periods of time and make relatively large changes in position when they do change. On the other hand, if the costs Senators face are convex in nature, we would expect to see "wishy-washy" Senators. These Senators would change position more often, but with only small moves. Knowing the nature of the costs to changing position is important for predicting electoral equilibria and will shed light on which theoretical models of electoral competition are most appealing on empirical grounds.

The results suggest economically and statistically significant costs of changing position. Further, models that best fit the data are those in which the costs to changing position are convex, with the best fitting model being the linear adjustment costs model. That is, the data show Senators who are not "flip-floppers", but change positions slowly. The standard Downsian model, and the median voter models of political equilibrium are found to be inconsistent with the data on the ideological positioning of U.S. Senators. The theoretical models found to be most consistent with the data are those where the costs to adjusting one's position are linear in

nature.

2.1 Previous Literature and Motivation

Models predicting non-convergence of policy platforms in two candidate elections with a single policy dimension come in several flavors. Alesina (1988a) presents a model where politicians care about policy in addition to the rents from office and cannot commit to policy platforms. This creates a principal agent problem between the representatives and the voters. While the candidate would like to promise the median voter's preferred position to win the election, such a promise may not be credible and there for candidate platforms will not converge. A second type of model whose equilibrium may have non-convergence relies upon uncertainty by the voters about the policy to be implemented when the candidate takes office. The policy in office may differ from the announced policy because of preferences by the politician (as in Alesina (1988a)), because of future events or because the candidate is unsure about his own preferred position. Enelow and Munger (1993), Bernhardt and Ingberman (1985), Ingberman (1989), and Banks (1990) all describe models of this type and derive the equilibrium conditions of electoral competition. Models of Kartik and McAfee (2007), Callander (2008), and Callander and Wilkie (2007) adopt a combination of the previous two types. Some candidates are policy motivated and others are purely office motivated. However, voters are uncertain about the type of the candidates. Candidates may also have some attribute such as "character" that is valuable to the voters, beyond the policy choice of the candidates. The uncertainty about type of the candidates causes announced positions to become signals of a politicians type,

leading to non-convergence of platforms.

Each of these models of non-convergence imply something about the adjustment costs faced by candidates. For example, Enelow and Munger (1993) derive the expected utility of the voters for electing a particular candidate and show the expected utility decreasing in the size of the change in the candidates' policy platforms. Bernhardt and Ingberman (1985) and Ingberman (1989) find similar results. The models of Banks (1990), Callander (2008), and Callander and Wilkie (2007), and Kartik and McAfee (2007) do not include past position as a state variable, but are only focused on positioning in a one-shot election where candidates may face a personal cost to misrepresenting their position. However, in a dynamic framework, signaling of one's motivation is done both through one's current choice of position, and through the dynamics of one's position. Whether the costs to adjusting position in dynamic versions of these models are convex, as in Enelow and Munger (1993), or non-convex (as might result from separating equilibria in a signaling game), depends upon the form of the personal costs to candidates for misrepresenting their position.

Empirical models of candidate positioning related to the analysis in the following sections include the work of Glazer and Robbins (1993), Ansolabehere, James M. Snyder, and Charles Stewart (2001), Levitt (1996), Bronars and John R. Lott (1997), Poole (2003), and Poole and Rosenthal (1997). Glazer and Robbins (1993) find the ideological preferences of voters have a substantial effect on the ideological positions of their Representatives. Using the Conservative Coalition interest group's scores to identify the ideological position of Congressman, they find the voters exert much control over the position of their Congressman and deviations from the voters

position are small, even for senior congressman. Ansolabehere, James M. Snyder, and Charles Stewart (2001) use the National Political Awareness test to identify the positions of both incumbents and challengers in over 100 years of House elections. They find much of a candidates ideology is explained by his party, and in contrast to Glazer and Robbins (1993), find little of a candidates ideological position is determined by local conditions. Levitt (1996) finds Senators place the most weight on their own ideological preferences, with the remainder of their ideological stance being approximately equally determined by the preferences of their constituents and their party. Bronars and John R. Lott (1997) find one's roll call vote choices are not affected by PAC contributions, but that PAC contributions are determined by one's ideological position. Poole (2003) finds little variation in a Congressman's position over his career when using his Nominate scores to define ideological positions. Poole and Rosenthal (1997) find the vast majority of the variation in roll call voting records can be accounted for by a single dimension, the liberal-conservative spectrum. For example, how one votes on school-vouchers correlates very highly with how one voters on tax reform and how one votes on welfare programs. Poole and Rosenthal (1997) have found this single dimension is able to explain the majority of roll call voting patterns, especially after the passage of the Civil Rights Act of 1964. In fact, they find over 90% of roll call vote choice can now be explained by the single dimension, liberal-conservative spectrum. The empirical results and the theoretical models described above motivate my use of such a single dimension in the empirical analysis done here.

None of the empirical work cited presents a dynamic model of candidate posi-

tioning. The construction of a quantitative, dynamic model of candidate positioning is one of the major contributions of this work. However, the model and estimation used here owes much to work in dynamic industrial organization, such as by Cooper and Haltiwanger (2006). Cooper and Haltiwanger (2006) study the nature of costs to manufacturing plants when adjusting their stock of physical capital. The analysis here draws heavily on their methods and characterization of adjustment costs. One can see a similarity between a plant's choice of physical capital for next period based on current and expected productivity shocks and a candidates choice of position, which is based on the current and expected positions of the voters.

The remainder of the paper is organized as follows: Section 2 describes the data used and Section 3 discusses the reduced for evidence for a model in which Senators face costs to changing position. Section 4 outlines the model of candidate positioning in a dynamic environment. Section 5 presents the econometric methodology and discusses identification. Section 6 presents the results and Section 7 concludes.

2.2 Data

Estimation of the model of candidate positioning requires data on the ideological positions of Senators and their constituents, observations of Senator retirement decisions, and data on election outcomes. The data on Senate retirements and election outcomes is straight forward to collect. These data come from Stewart and Woon (2006), the ICPSR, and the Federal Election Commission and I omit and detailed discussion of these data sources. The data on ideology requires a more thorough description.

Data on the ideological position of Senators and voters come from the Americans for Democratic Action (ADA) interest group ratings of roll call votes. Each year, the ADA select a subset (20 votes) of the year's roll call votes and rate each Congressman on a scale of 0 to 100, where 0 means the Congressman voted against the ADA's position on every roll call vote and 100 means the Congressman voted for the ADA's position on every roll call vote. A score of 0 indicates the the Congressman is very conservative and a score of 100 indicates the Congressman is very liberal, as defined by the ADA. The sample period is 1947-1999. [1]

Adjustments are made to these scores to allow them to be comparable across time and chambers. These adjustments are described in Groseclose and Steven D. Levitt (1999). Such adjustments to the raw ADA scores are necessary because the issues voted on vary over time and across chambers and so the raw scores are not directly comparable. The adjustments are used to allow the ADA scores to shift and stretch across time and chambers. Thus converting raw scores to adjusted scores is similar to converting temperature from Fahrenheit to Celsius. The adjusted scores are not bounded between 0 and 100. Table 2.1 presents some summary statistics for the adjusted and nominal ADA scores, separating out the scores for each major party.

There are several advantages to ADA scores over other measures of ideology, such as the Nominate scores of Keith Poole and Howard Rosenthal. First, ADA scores have a clear definition (i.e. position on the liberal-conservative spectrum, as defined

[1]Data from 1947-1959 is constructed by Tim Groseclose based on the ADA's methodology and list of key votes for 1947-1959. The ADA did not publish scores for this time period. Also, scores were not calculated for 1962 and 1964.

Table 2.1: ADA Scores

Variable	Mean	Std. Dev
Adjusted ADA Score	37.774	29.826
Democrats, Adjusted ADA Score	54.849	25.223
Republicans, Adjusted ADA Score	16.872	20.190
Nominal ADA Score	46.018	31.888
Democrats, Nominal ADA Score	64.655	26.596
Republican, Nominal ADA Score	23.206	21.172

by the ADA). Second, due to the work of Groseclose and Steven D. Levitt (1999), they are comparable over time and across chambers [2]. Third, they are reported at a higher frequency. [3]

The ideological position of each state's voters is proxied for by the mean of the ADA scores of the state's House delegation. This follows the work of Levitt (1996), who uses the same proxy for the preferences of each state's voters. Figure 2.1 suggests the mean score from the House delegation is a reasonable proxy for the preferences of the voters given the close alignment between the positions of Senators and the voter proxy. [4]

Because the ADA scores are based on such a small number of votes, there may be much year to year variation due to the votes the ADA considers each year. To mitigate this noise, I define a period as a term in the Senate and average the scores across the period. I do not calculate scores for Senators who did not receive a score in

[2]D-Nominate scores are comparable over time, but not across chambers. They are also constructed in such a way as to constrain the ideological position of a Congressman to change in a linear fashion.

[3]ADA scores are reported annually, whereas Nominate scores are reported only for each Congress.

[4]I plan to also try the median stance of the House delegation and possibly other aggregates as the proxy for voter preferences.

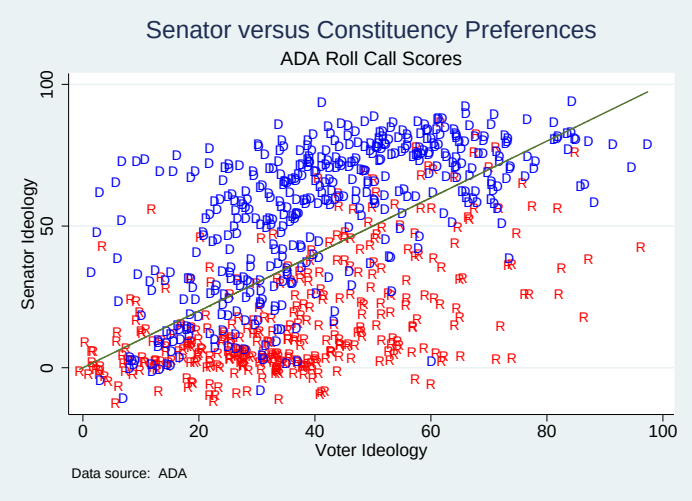

Figure 2.1: Correlation of Senator and Voter Ideology

2 or more years of the 6 year term, ensuring the ideological position of each Senator is based on at least 80 votes. This leaves me with 809 Senator-term observations over the sample period of 1947-1999. Included in this sample are 357 different Senators. Of these 124 serve only one term, 95 serve two terms, 71 serve three terms, 45 serve 4 terms, and 22 serve five or more terms during the sample period. From the sample, I am able to observe 470 potential changes in position.

Table 2.2: Summary Statistics

Variable	
Mean years observe Senator	10.466
Mean size of change	0.286
Mean of abs value of change	6.630
Serial Correlation of changes	-0.113
Serial Correlation of Abs Value of Changes	0.260
Correlation of changes in Voter and Senator	0.060
Correlation of voter and Senator ideology	0.544
Fraction of Jumps ($\geq$ 20 point change)	0.019

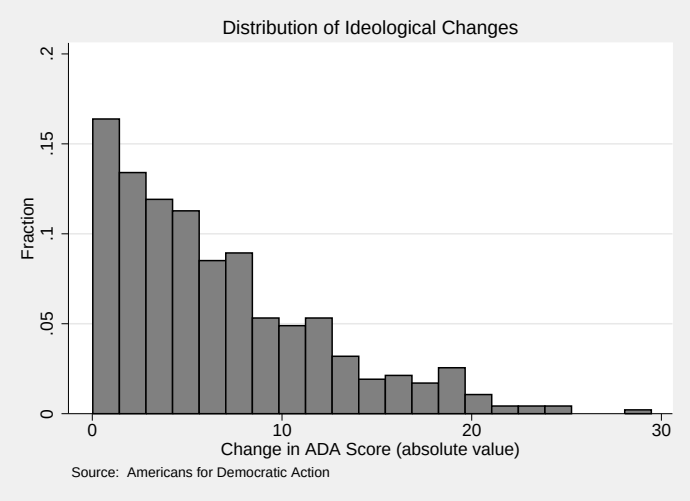

Figure 2.2: Distribution of Changes in Position by Senators

Summary statistics for the ADA data are presented in Table 2.2. A histogram of the distribution of ideological changes are presented in Figure 2.2. Figure 2.2 presents the absolute value of changes ($|P - P_{-1}|$) and shows a distribution with a mass toward zero. Since upward and downward movements (i.e. becoming more liberal or conservative) are assumed to have identical costs, this figure is important for thinking about whether those costs are convex or non-convex. Convex costs would suggest most movements would be small and there would be a positive correlation between the movements. Indeed, the mass towards zero supports this. Over 11% of the changes are less than one point on the ADA scale and over 20% are less than 2 points on the scale. Non-convex costs would suggest a long right tail (i.e. many Senators making big jumps), which is not evident from Figure 2.2. Of all changes in position, the moves larger than 20 points on the ADA scale account for about 6.7% of the total change in position. These "jumps" constitute 1.9% of the observations.

If costs were zero, then one would expect a high correlation between changes in voter ideology and changes in Senator ideology and also a high correlation between the observed ideology of Senators and voters. The correlation of changes in Table 2.2 is low, at 0.06 and the correlation of observed ideologies is 0.544. A model with zero costs of adjusting position would result in both of these correlations being 1.00.

2.3 Reduced Form Evidence

The distance between the position of the Senators and the voters as measured by the ADA scores certainly has an effect on electoral outcomes. The unconditional correlation between a Senators' share of the two-party vote and his distance from the voters is -0.25 and is plotted in Figure 2.3. This relationship is strong and negative, as one might expect.

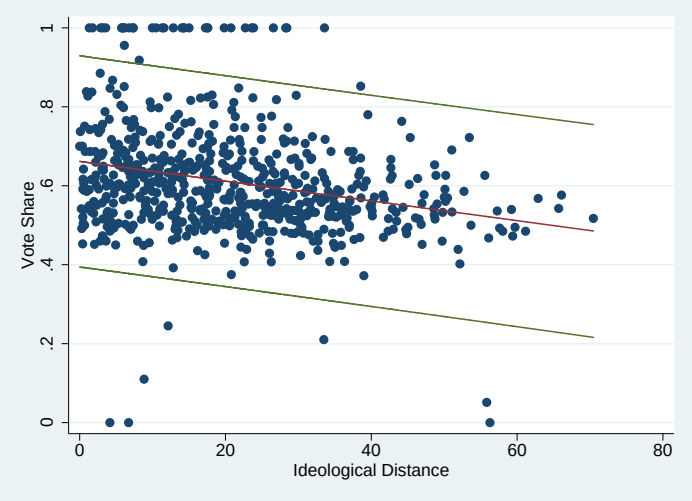

Figure 2.3: Correlation of Ideological Distance and Vote Share

Changing position also negatively effects ones electoral prospects. The un-

conditional correlation between the candidates share of the two party vote and the absolute value of his change in position is -0.08 (Figure 2.4). While not as strong as the relationship between distance and vote share, changes in position suggest a worse electoral outcome.

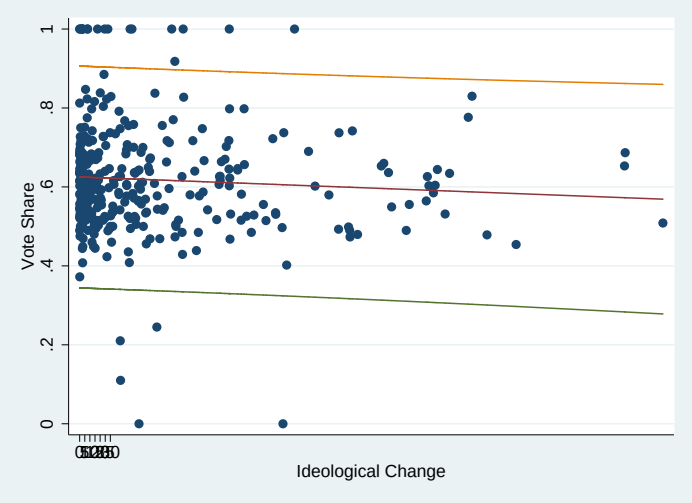

Figure 2.4: Correlation of Ideological Change and Vote Share

One might worry the unconditional correlation between vote share and the size of a candidates change in position is biased downward because those who change in position are likely to be those whose ideological position is far from the voters' preferred point. To correct for this, I regress the candidates share of the two party vote on ideological distance, changes in ideology, and changes in state economic conditions, candidate seniority, and national and state trends in party popularity. Tufte (1975) and Erikson (1990) find support for the role of economic conditions in the outcomes of Congressional elections and prompt me to control for changes in state income. Alesina and Rosenthal (1989) find controlling for national sways in opinion are important,

therefore I include fixed effects for the interaction of the candidate's party and the year of the election. I also include fixed effects for party-state interactions, as a Democrat who is elected in a Republican state may face stronger opposition in elections than a Republican, even if the measured ideology is the same.

Table 2.3: Effects of Changes in Ideology on Incumbent Vote Share

Dependent Variable:	Candidate's	Share of	Two	Party	Vote	
Model:	1	2	3	4	5	6
Ideological Distance	-0.004***	-0.005***	-0.004***	-0.001	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Abs(Change in Ideology)	-0.172		-0.374	-0.118		-0.266
	(0.128)		(0.406)	(0.145)		(0.438)
Square of Change in Ideology		-0.007	0.011		-0.005	0.008
		(0.006)	(0.020)		(0.008)	(0.024)
Seniority	1.149	1.164	1.132	-0.958	-0.965	-0.967
	(0.709)	(0.714)	(0.708)	(0.797)	(0.799)	(0.799)
% Change in State Income	11.898	11.795	11.89	2.568	2.542	2.646
	(8.624)	(8.641)	(8.649)	(8.723)	(8.714)	(8.762)
Year*Party Effects	Yes	Yes	Yes	Yes	Yes	Yes
State*Party Effects	No	No	No	Yes	Yes	Yes
Obs	325	325	325	325	325	325
R^2	0.972	0.971	0.972	0.986	0.986	0.986

Table 2.3 reports the results of these regressions. Ideological distance is defined as the square of the distance between the voters and the Senator, $(\theta - P)^2$. Changes in ideology are measured in two ways. First, by the absolute value of the change, $|P_i - P_{i,-1}|$. Second, by the square of the change in position, $(P_i - P_{i,-1})^2$. The coefficients on distance from the voters and changes in positions have the expected (negative) sign in all specifications. Changes in state income are positively related to a candidates electoral prospects, which is anticipated, as all candidates included in the regressions are incumbents. In fact, they are all incumbents with at least two terms

of tenure, which is needed to calculate changes in position. The effect of seniority is not consistent across models, but after the "sophomore surge", the literature finds small returns to being an incumbent.

While the change in ideology isn't statistically significant, I find changes in position negatively affect ones vote share in any model. A 10 point change in ideology results in a decrease of between 1.1 and 3.7 percent of the vote share, which is non-trivial. In fact, in model (1), a change in position of 6.63 ADA points (the average size of a change in position) is equivalent to a candidate being 9 ADA points further away from the voters. A difference of 9 points is more than the average distance between the positions of John McCain and Strom Thurmond.

There is a potential for a downward bias on the coefficients on ideological distance and changes in position. This bias comes from two sources. First, if running in an election is costly, those who run are likely to be those who anticipate winning. This means, those who are closer in position to the voters and who do not have to make large changes will run for office, while those who are far from the voters and would have to make large changes do not run. Second, even among those who run, those who change position are going to be those who are more likely to lose the election. That is, the decision to change position is in part determined by the likelihood of winning, which not only affects the decision of running, but is related to vote share if one does run. In order to account for these possible sources of bias, I estimate Heckman selection models where I instrument for the decision to run with the candidates seniority and models in which I instrument for changes in position with the change in position of the voters. Both models give larger point estimates of

the coefficients on changes in position, but the standard errors are very large.

Another way to control for selection and the endogeneity of changes in position is to estimate a model of candidate positioning in a more direct fashion. This has the further advantage of controlling for the position of challengers. By not controlling for the position of challengers, I am biasing the estimates of the effects of changing position. For example, imagine a case where the challenger takes a position very near the median voter and has a record that is close to the median as well. In such a case, the incumbent will likely have to move close to the median also, but he will face a low probability of winning since the challenger is also close to the median voter. So a large change comes with a low probability of victory, biasing up the estimates of the electoral costs to changing position. In the next section, I discuss the theoretical model of candidate positioning when changing position is costly.

2.4 A Dynamic Model of Candidate Positioning

2.4.1 Model of Voters

Let a voter's preferred position and identity be θ. Candidates and voters have common knowledge of θ, a point in a one dimensional policy space. Call this space "ideology".

Voters are myopic, voting for the candidate in the current election who maximizes their expected utility, a function of the policy the candidate puts into place one in office. Further, assume the demographics of the district change over time. That is, the distribution of θ will evolve. Thus $median\theta_t$ may not equal $median\theta_{t+1}$. Note, while the distribution of θ changes, this does not mean each of the voters' preferred

points change only that there are changes in the composition of individuals that make up the Senators' constituencies.

Assume the voter's utility is quadratic so the expected utility of θ voting for candidate i is:

$$Eu(i,\theta) = E(-(P_i^{'} - \theta)^2) - C(P_i, P_{i,-1}) + \xi_i \tag{2.1}$$

Where ξ_i is a random component to the voters' utility, which is distributed i.i.d. and is unobserved by the candidates at the time of their platform choices. This can represent some surge of popularity during the election that is orthogonal to the popularity of the platform and is often called "valence" in the political science literature.

The function $C(P_i, P_{i,-1})$ is the "cost of adjustment". In a sense it is a punishment by the voters for a candidates change in position. One may parameterize this function in several ways, according the story of electoral competition on thinks correct. I discuss the specification of this function shortly.

The state variables for the voters' problem are the voters' preferred points, θ, the current positions of the candidates, P_i, the past positions of the candidates, $P_{i,-1}$, and the transitory shock to the candidates' electoral chances, ξ_i.

2.4.2 Candidates

The model period unfolds in the following order. First, the incumbent chooses his policies and platform in office, P_i. Together, the incumbents record from previous

periods, $P_{i,-1}$ and the current policy choice influences the voters' expectations about the incumbents position, $E(P_i^{'})$, and the cost of adjustment associated with the position, $C(P_i, P_{i,-1})$. After $E(P_i^{'})$ and $C(P_i, P_{i,-1})$ are determined, the challenger selects his current platform given his record and the position of the incumbent. Last the election is held and the winner realized.

Politicians care only about the rents from office and not their policy positions per se. Therefore, they chose a position to maximize the utility of the median voter and thereby maximize the probability of getting elected.

Given the assumption of $\xi_i \sim$ i.i.d. Type 1 Extreme Value and additive separability, we can write the politicians expected probability of victory as:

$$Pr(i\ wins|P_i, P_{i,-1}, P_{i,-1}, P_{j,-1}, med\theta) = \frac{exp(Eu_i(P_i, P_{i,-1}, med\theta)}{\sum_{i=1}^{2} exp(Eu_i(P_i, P_{i,-1}, med\theta))} \tag{2.2}$$

Therefore, candidate i chooses the P_i to maximize:

$$W_i(P_{i,-1}, P_j, P_{j,-1}, med\theta) = R + \beta Pr(P_i, P_j, P_{i,-1}, P_{j,-1}, med\theta) E_{med\theta, P_j^{'}} W_i(P_i, P_j^{'}, P_j, med\theta') \tag{2.3}$$

Candidates choose a position to maximize the probability of getting elected. This is highest if they get as close to possible (again, bearing in mind the costs of adjustment) to the median voter in each period. Without a stochastic term in the instantaneous utility function of the voter, this is 0/1, with the winner completely determined by the past positions of the candidates.

2.4.3 Equilibrium

An equilibrium is found when: 1) Voters chose the candidates who maximizes utility, given the relevant states variables, including current positions of candidates 2) Incumbents choose positions to maximize utility, given the preferences of voters and the positions of challengers. [5]

2.4.4 Costs of Ideological Adjustment

2.4.4.1 Zero Costs of Adjustment

If changing position has no effect on a candidate's electoral prospects, then we are in the stylized Downsian world. In this case, $C(P, P_{-1}) = 0$ and candidates will always align themselves with the current position of the median voter, regardless of their past position.

2.4.4.2 Convex Costs of Adjustment

Bernhardt and Ingberman (1985), Ingberman (1989), and Enelow and Munger (1993) derive equilibria of electoral competition when voters are uncertain about the policies of candidates. The voters may be unsure the candidate will deliver on their campaign promises for a number of reasons. Writing the expected utility of voting for candidate i:

[5] Voters expectations about future positions of candidates do not have to be consistent with the choices made by candidates in the model, as I am not enforcing rational expectations on the part of the voters. This is consistent with the assumption of voters who are not aware of the game the candidates are playing.

$$Eu(i,\theta) = E(-(P_i^{'} - \theta)^2) + \xi_i \tag{2.4}$$

One can pass through the expectations operator, perform some algebraic manipulation and find:

$$Eu(i,\theta) = -(E(P_i^{'}) - \theta)^2) - \sigma_{P_i}^2 + \xi_i \tag{2.5}$$

Here, costs to changing position are represented by uncertainty by the voters about the future positions of candidates. Given risk averse voters, as uncertainty about the future policies of the candidates increases, expected utility decreases. As shown by Enelow and Munger (1993), voters may use the past record of candidates to update their expectations about the candidate. In Enelow and Munger (1993), a change in position by the the politician increases the uncertainty of the voters and does so in a quadratic manner. Uncertainly increases at a rate proportional to the squared difference between the politicians past and current positions. This result is captured in the following specification of adjustment costs:

$$\sigma_P^2 = C(P, P_{-1}) = \frac{\gamma}{2}(P - P_{-1})^2 \tag{2.6}$$

Facing the convex adjustment costs of Equation 2.7, Senators will not be very responsive to changes in the preferences of their constituents. While candidates will want to align themselves with the voters, the costs of changing position increase quickly as one makes larger moves. Such costs force Senators to change position only

in small increments. Senators will be "wishy-washy", making slight moves in any direction as the voters' preferred points in the ideological space change, but rarely making large jumps in their ideological position.

In addition, I also estimate a model where the costs of adjustment are linear. Such costs are consistent with the models of Bernhardt and Ingberman (1985) and Ingberman (1989), who allow the uncertainty of voters to be any function that is increasing the size of the deviations of candidates from their past record. These costs take the following form:

$$\sigma_P^2 = C(P, P_{-1}) = \kappa(|P - P_{-1}|) \tag{2.7}$$

2.4.4.3 Non-convex Costs of Adjustment

Still other models of candidate positioning assume the costs of adjusting one's position is the signaling of one's character. That is, voters derive utility from both the ideological stance of the politician and from the "character" of the politician. Kartik and McAfee (2007) and Callander and Wilkie (2007) models with just such a mechanism. In a dynamic version of these models, there may be a non-linear relationship between the size of one's change in position and the penalty on pays for the change. If one either has character or does not (as in Kartik and McAfee (2007)), holding one's ground signals good character, any change in position signals one has no character. In a separating equilibrium, no character types will reveal themselves by changing position. Since character is valuable, these candidates will face a lower probability of election than candidates who have the same platform, but

have character. This is modeled by a non-convex cost of adjustment where there is a fixed cost to adjusting position. The adjustment cost function is thus:

$$C^{NC}(P, P_{-1}) = 0 \tag{2.8}$$

Where C^{NC} is the cost function when one does not change position ($P = P_{-1}$). And:

$$C^{C}(P, P_{-1}) = -F \tag{2.9}$$

Where C^{C} is the cost function when one changes position and F is the fixed cost to changing position. Call the associated probabilities of re-election $Pr^{NC}(P_{i,-1}, P_j, P_{j,-1}, med\theta)$ and $Pr^{C}(P_i, P_{i,-1}, P_j, P_{j,-1}, med\theta)$, respectively. On can thus write the dynamic programming problem of the Senator as:

$$W(P_{i,-1}, P_j, P_{j,-1}, med\theta) = max[W^{NC}(P_{i,-1}, P_j, P_{j,-1}, med\theta), W^{C}(P_{i,-1}, P_j, P_{j,-1}, med\theta)] \tag{2.10}$$

Where

$$W^{NC}(P_{i,-1}, P_j, P_{j,-1}, med\theta) = R + \beta Pr^{NC}(P_{i,-1}, P_j, P_{j,-1}, med\theta) E_{med\theta, P_j'} W(P_i, P_j', P_j, med\theta') \tag{2.11}$$

and

$$W^C(\theta, P_{-1}, \xi) = R + \beta Pr^C(P_i, P_{i,-1}, P_j, P_{j,-1}, med\theta) E_{med\theta, P_j'} W(P_i, P_j', P_j, med\theta') \tag{2.12}$$

Candidates facing fixed costs to changing position will changes positions only when they are further away from the voters than a certain threshold, as determined by F. Senators facing fixed costs to adjustment often hold positions for a long period of time, but make larger changes than those in the convex models when they do change.

2.5 Structural Estimation

2.5.1 Empirical Model

One must make assumptions about the expectations of voters. I assume voters have the following expectations. First, $E(P_i') = \lambda P_i + (1 - \lambda) Emed\theta'$. [6] Voters take into account the evolution of the distribution of preferences when forming expectations over next periods policy choice. As in Bernhardt and Ingberman (1985), Ingberman (1989), and Enelow and Munger (1993), one might assume the function $C(\cdot, \cdot)$ is increasing in the distance between a candidates current policy choice and his record. That is, voters perceive candidates who have larger changes in position as

[6] The policy put in place next period may differ from voter's expectations because of the realization of θ'. In addition, voters have uncertainty because they do not know the game the politicians are playing. Voters are not assumed to have rational expectations. This is consistent with the work of Bernhardt and Ingberman (1985), Ingberman (1989), and Enelow and Munger (1993). I follow their arguments against requiring rational expectations on the part of voters. The general argument is that RE places to much discipline on the behavior of voters whose contribution to the election outcome is so small. Retrospective voting strategies are supported by Fiorina (1981) and even by Downs (1957).

having more uncertainty in their policy choices next term. Candidates whose current platforms are consistent with their records create less uncertainty in the minds of voters. Or one might follow the stories of Kartik and McAfee (2007) and Callander and Wilkie (2007) where politicians have character. Such a model leads to costs of adjustment that are independent of the size of one's change in position.

In order to estimate the dynamic model described above, one needs data on the past records of both candidates, the current positions taken by both candidates, and the preferred position of the median voter. While I use ADA scores to proxy for the current and past positions of those who have served in the Senate, I don't observe the past positions of first term Senators and I observe neither the past nor the current position taken by those who have never served in the Senate.

Because of this limitation, I am going to make the following assumptions about the past positions of challengers and about the uncertainty voters have about the future positions of these challengers. The model of challengers is rather reduced form, but consistent with both an incumbency advantage (as in Bernhardt and Ingberman (1985)) and with the model of candidate positioning described above.

I assume a challenger's current position, P_C, and the costs associated with this position, C_C, are drawn from a stationary bivariate normal distribution with mean μ and covariance Σ_C. These assumptions imply the expected utility of electing a challenger is:

$$Eu(C,\theta) = -(E(P_C^{'}) - \theta)^2 - C_C + \xi_C \tag{2.13}$$

Where the function $E(P_C')$ is a function of the current position of the challenger, P_C, which is modeled as a random draw. The lack of data on the past positions of those who have not served in the Senate necessitated the modeling of P_C as a random process. In addition, because I do not want to assume challengers and incumbents face the same costs to changing position, the costs of adjustment, C_C, associated with the challenger and his position is also a random draw. That is to say, I model the challengers' best response function as a random process. I could have made an assumption about the challengers' cost of adjustment function and only have had to draw the past position of the challenger, but one is not able to identify both the parameters of this cost function for the challengers and the distribution of their past positions. Therefore I model the best response function (a current position and adjustment cost) of the challengers by a stochastic process. Allowing for a correlation between ones current position and the uncertainty of future positions is natural as one might expect there to be more uncertainty if a candidate adopts a more centrist position because he may be playing to the voters (see Enelow and Hinich (1981), Kartik and McAfee (2007))

This all implies the probability the incumbent wins can be written as:

$$Pr(i\ wins|P_I, P_{I,-1}, P_C, \sigma_C^2, med\theta) = \frac{exp(Eu_I(P_I, P_{I,-1}, med\theta)}{exp(Eu_I(P_I, P_{I,-1}, med\theta)) + exp(Eu_C(P_C, \sigma_C^2, med\theta))} \tag{2.14}$$

The assumptions on the utility and expectations of voters, on the stochastic valence of candidates, on the motivation of candidates, and the exogenous process

describing challengers put structure on the model. The parameters of this structure is estimated using data on the positions taken by Senators on the liberal-conservative spectrum defined by the ADA. The candidates' rate of time preference β is set to an annual rate of 0.96. The expected value of a candidate's policy next period is determined by expectations about he evolution of the median voter and the parameter λ. This parameter is pinned down by the equilibrium condition requiring voters to have expectations about the future policy that are correct on average. The following parameters need to be estimated: μ, Σ_C, and the parameters describing the costs of adjustment function $C(P_i, P_{i,-1})$. I assume the mean of the distribution of challenger ideology is the same as the mean from the distribution of the median voters' preferred points. For the following analysis, I also assume the covariance between the ideology of challengers and the adjustment costs of challengers is zero. These assumptions leave me four parameters to estimate for each model : the mean costs of adjustment associated with challengers, $\bar{C}_C$, the standard deviation of challenger positions, σ_{P_C}, the standard deviation of challenger adjustment costs, σ_{C_C}, and γ, κ, or F, if the model if the convex adjustment cost model or the non-convex adjustment cost model.

Additionally, one needs to know the median preferred point of the voters. This is proxied for by the mean ADA score of House members from the state. It's evolution is assumed to follow a stationary AR(1) process, the parameters of which is estimated outside of the structural model (since it is exogenous to the choice of position by Senators).

2.5.2 Estimation Procedure

The parameters underlying the model of candidate positioning, $\Theta = (\mu, \Sigma_C, \gamma, \kappa, F)$, are estimated using a simulated method of moments (SMM) procedure as described in McFadden (1989). The use of SMM over alternative methods of estimation such as maximum likelihood, was done for several reasons. First, SMM is transparent. The moments I choose to match are well measured, clearly defined, and easily interpreted. Second, ML is more computationally burdensome to estimate since one must calculate the conditional probabilities of changes in position at all the grid points in the state space.

The procedure has the following algorithm. For a given vector of parameters, Θ, the dynamic programming problem (DPP) of the Senator is solved for. The solution to the DPP is a set of policy functions determining the Senator's optimal choice of ideological position given his past position, the past position of the challenger, the adjustment cost associated with the challenger's position, and the current position of the voters and the electoral shock ξ. These policy functions are used to simulate a panel of Senators and voters. A set of moments is calculated from the simulated panel. Call the vector of simulated moments $\Psi^s(\Theta)$.

The estimate $\hat{\Theta}$ is the vector of parameters that minimizes the weighted distance between $\Psi^s(\Theta)$ and the vector of moments from the data, Ψ^d. Formally, $\hat{\Theta}$ solves:

$$\pounds(\Theta) = min_{\Theta}[\Psi^d - \Psi^s(\Theta)]'W[\Psi^d - \Psi^s(\Theta)] \tag{2.15}$$

Where W is the optimal weighting matrix, calculated as the inverse of the variance covariance matrix of the data moments, as described in Smith (1993). This weighting matrix is the inverse of the variance-covariance matrix of the moments, calculated by bootstrapping the data. Using the SMM procedure with the optimal weighting matrix ensures consistent and efficient estimates of Θ.

In the minimization routine, the vector Θ is updated using a simulated annealing algorithm (Goffe and Rogers (1994)). Such an algorithm is very effective at finding the global minimum in cases where the objective function is non-linear in its parameters, as in this case.

2.5.3 Estimating the Preferences of Voters and Non-electoral Exit Probabilities

In addition to the parameter vector Θ, the decisions of the Senators depend upon retirement probabilities and the expectations of the future positions of voters.

Retirement probabilities are assumed to be constant. On average, just under 10% of Senators retire each term. The probability of retirement, δ, is found to be 0.097. [7]

Understanding the persistence and variability in the preferences of the voters is an important component to the solution of the Senators' dynamic programming problem. The bliss point of the decisive voter is unaffected by the positions of the

[7] This is the simplest case. In general, the retirement probability may depend upon age and the distance between the Senator's position and the position of the voters. The distance between voters and Senators may affect the retirement probabilities because elections are costly and therefore one's decision run may depend upon their chances of winning. The chance of winning depends upon, among other things, the ideological distance between the voters and the Senator.

Senators and is assumed to follow and AR(1) process:

$$med\theta_{i,t} = (1-\rho)\mu_i + \rho med\theta_{i,t-1} + \epsilon_{i,t} \tag{2.16}$$

It is assumed $\epsilon \sim N(0, \sigma_\epsilon)$. The preferences of the decisive voter are proxied for by the mean score of House Representatives from the Senator's state as done in Levitt (1996). The AR(1) process is estimated using a least squares approach where the mean of the auto-regressive process is allowed to vary across states. Both ρ and σ_ϵ are restricted to be constant across states and are found to be 0.44 and 11.50, respectively. The AR(1) process is then approximated by a first-order Markov process following the method of Tauchen (1986) to determine the transitions of the voters in the discretized state space of the computational model.

2.5.4 Moments and Identification

To estimate Θ, I choose to match the following moments: the fraction of jumps [8], the serial correlation of changes in position, the re-election rate of incumbents, the correlation between re-election rates and the distance between a senator and voter's position, the correlation between the ideology of Senators and voters, the correlation between the ideology of Senators and voters for first term Senators, and the standard deviation of positions for first term Senators. While each of moment is affects by every parameter to some extent, I discuss next which moments contribute most to the identification of each parameter.

[8] A jump is defined to be a change in a Senator's position of at least 20 points on the ADA scale.

Table 2.4: Moments Used For Estimation

Moment	
Fraction of Jumps ($\geq$ 20 point change)	0.019
Serial Corr of Changes	-0.113
Incumbent Re-election Rate	0.832
Correlation(win,distance)	-0.111
Correlation of voter and Senator ideology	0.544
Correlation of voter and 1st term Senator ideology	0.500
Freshman Re-election Rate	0.807

The fraction of jumps and the serial correlation in changes of position are most informative about the size and nature of the costs of adjustment. In the quadratic adjustment costs model, a larger value of γ implies fewer jumps. The fixed-cost model has more jumps s than the quadratic model, and the number of jumps increases as F decreases (for certain ranges of F).

The serial correlation is also informative about the nature of the costs of adjustment. With quadratic costs of adjustment, one will find a relatively high degree of serial correlation. This is because Senators will not make large changes in position all at once because the costs to changing position are increasing with the size of the change. With linear costs of adjustment, the marginal cost of a change in position does not depend upon the size of the change, so the changes will be larger and the serial correlation lower. When costs are independent of the size of one change, as in the fixed cost case, the serial correlation will be lowest. Under fixed costs of adjustment, candidates will only change position when they are beyond a certain threshold from the voters. When Senators facing fixed costs change position, they will move very close to the voters at one time, resulting in a serial correlation that will be lower than in the two models of convex adjustment costs.

Re-election rates are determined by a number of the parameters, but they help to pin down the distribution of standard deviation of challenger uncertainty, $\bar{\sigma}_C$. Higher levels of challenger uncertainty lead to a larger incumbency advantage and thus higher incumbency re-election rates.

The correlation of Senator and voter ideology is significantly affected the size of the costs of adjustment and the the standard deviation in the level of challenger uncertainty, σ_{σ_C}. To separate the standard deviation in the uncertainty associated with challengers from the size of the costs of adjustment for incumbents, I include as a moment the correlation of Senator and voter ideology for first term Senators only.

Finally, the standard deviation of challenger positions, σ_{P_C} is identified by matching re-election rate of freshman Senators. This rate is is determined by the positions these Senators campaigned on and the electoral cost to changing this position.

2.6 Results of Structural Estimation

The structural model is estimated estimated using ADA data from 1947-1999. Table 2.5 presents the results of estimation, reporting the parameters of the cost function, the values of the moments and the minimum statistic. All models are estimated fixing λ at 0.5 and the covariance of challenger position and challenger adjustment costs at 0. In addition to the baseline cases of zero, quadratic, linear, and fixed costs to adjustment, I also estimate a combination model. This model combines the quadratic costs of adjustment with fixed costs to adjustment. Such a model allows for both the role of uncertainty (as in Enelow and Munger (1993)) and character (as in Kartik and McAfee (2007)).

Using the minimum statistic as the criteria, the model with linear adjustment costs does the best at capturing the relevant moments. It is able to come very close to all four moments, and, in particular, does a much better job than the fixed cost model on matching the small number of large moves found in the data. The model with no costs of adjustment is clearly rejected by the data, with Senators being much too responsive to changes in voter ideology.

Table 2.5: Results of Structural Estimation

Model	No Cost	Linear	Quadratic	Fixed Cost	Fixed and Quad	Data
Parameters						
γ	0.000	0.000	2.040	0.000	0.983	-
	-	-	(1.700)	-	(0.119)	-
k	0.000	12.358	0.000	0.000	0.000	-
	-	(0.045)	-	-	-	-
F	0.000	0.000	0.000	360.453	73.896	-
	-	-		(97.392)	(34.716)	-
Moments						
Frac Jumps	0.173	0.015	0.000	0.048	0.003	0.019
Serial Correlation	0.340	0.217	0.333	0.054	0.237	-0.113
Re-elect Rate	0.832	0.836	0.830	0.820	0.846	0.832
Corr Ideo	1.000	0.560	0.551	0.366	0.548	0.544
Corr Win/Dist	-	-0.033	-0.015	-0.006	-0.024	-0.111
Corr Ideo, Freshman	1.000	0.497	0.413	0.358	0.451	0.500
Re-elect Rate, Freshman	0.806	0.832	0.826	0.817	0.841	0.807
$\mathcal{L}(\Theta)$	1054.983	22.232	58.238	78.292	33.593	-

As in the reduced for estimation, one finds large effects of changing position in the structural models. Any model with a some costs of adjustment does much better at matching the relevant moments than does the model with no costs of adjustment. In the linear cost of adjustment model, a change of 6.63 ADA points (an average size change) lessens a candidates chances of victory by the same probability as being about 9 points further away from the voter along the ideological spectrum. This is

very close to the quantitative significance found in the reduced form models.

Of the models with positive costs to adjustment, the worst fitting model is the model which posits fixed costs to adjusting position. In this model, any change in position, regardless of the size, established uncertainty in the minds of the voters and negatively affects a candidates electoral prospects. Such a model results in a serial correlation of changes that is closest to that found in the data, although no model can replicate the negative serial correlation found in the data without being much farther away from the other moments. Because of the large cost for any size change in position (any change incurs a cost equivalent to being about 18 points further way from the voters- more than the average distance between Senators Joseph Lieberman and Ted Kennedy), the correlation between the ideologies of Senators and voters is much lower than in the data.

Still, any model with a positive cost to adjusting one's position fits the data much better than the zero cost model. Senators move towards the voters, but, because of costs of adjustment, do not align themselves perfectly with the voters. Models where costs to changing position increase with the size of the change are the most consistent with the data.

2.7 Conclusion

The objective of this paper was to provide an understanding of the nature of "flip-flopping" among United States Senators. Using a large panel on the ideological positions of Senators and various empirical approaches, I have been able to come to several important conclusions regarding the costs Senators face when changing

position.

First, I was able to document electoral costs to changing position. These costs are economically significant, with changes in position being penalized as much as differences between the ideology of the voters and Senator. Furthermore, I was able to clearly show that models which include adjustment costs fit the data much better than the Downsian zero cost model. A model with a linear cost to adjusting position was found to fit the data best. That is, Senators face costs to deviating from their past records directly proportional to the size of their change in position.

Overall, the results provide more evidence against the stylized version of Downs' model and the validity of the median voter theorem as a description of a representative democracy. Flip flopping is indeed punished; Senators find moving towards the preferences of voters is best done in small moves. While multiple models of electoral competition are likely to be consistent with such a cost function, it is nonetheless important to understand such costs and their implications for electoral equilibrium such as non-convergence of candidate platforms.

Costs of adjusting position imply that the Median Voter Theorem (where the winning policy is that of the median voter) does not hold. Both my finding of costs of adjusting ones position and the empirical observation of the divergence of ideology between voters and Senators attest to the empirical failure of the median voter model. Understanding which model of adjustment costs fits the data best, will help in the development of a more realistic model of political competition.

A drawback of the model of electoral competition presented is that it does

not fully specify the dynamic models that result in the costs to adjusting position. Specifying such a model is left a worthwhile goal. To my knowledge, no one has written down a model where changes in ideological position are costly as the polls and the voters have rational expectations. Many have proposed models where such costs are incorporated in a reduced form way (see, for example Banks (1990)), but there is not a model addressing "flip-flopping" per se.

Confirming this model on other interest group ratings, such as those of the American Conservative Union, would help to ensure the results. Additionally, combinations of the models, such as a model with both a fixed and quadratic cost to adjusting may fit the data better. These will be addressed in future research.

Chapter 3

Political Parties as a Commitment Technology: Effects of Term Limits on Vote Share

Although political parties are a constant in democracies, they are often absent from models of political-economy. Theoretically and empirically there has been trouble supporting a useful role for political parties. When incorporated into models, political parties most often exist to increase voter turnout, choose political candidates, or to select policy platforms. In the following paper, I intend to provide support for the last of these roles. Like Levy (2004), I will show that political parties exist to increase the commitment ability of politicians. The way parties accomplish this, however, will be differ from Levy's hypothesis. In the following model parties will act as a commitment technology to politicians, even if the policy space is one dimensional, through repeated interaction with the politicians that make up the party.

Specifically, I will test the hypothesis that political parties play a role in solving the time consistency problems associated with the electoral game. I construct a model similar to Alesina (1988a) and Alesina (1988b) that implies larger parties will capture more of the vote in elections for offices that have term limits (i.e. where the last term of the politician is known) due to their ability to affect the space of credible platforms a candidate and campaign on. To test this implication of the model, I

estimate the change in vote share of Democratic and Republican candidates in state gubernatorial elections after the imposition of term limits. The imposition of term limits acts a shift in the structure of the game. Without term limits a politicians careers is modeled as an infinitely repeated game, but imposing term limits makes last period of the politician known and in this case a politicians careers is a finite stage games. In both the models of electoral competition, political parties provide incentives to politicians to help increase the space of credible platforms[1]. However, in finite horizon games, these incentives must be strictly larger than in the infinite horizon game, holding the policy position and preferences constant. To the extent that larger parties can more easily make larger transfers to the politicians, they should be more successful after the imposition of term limits. The data confirm this advantage. Using U.S. gubernatorial elections, I find that the two major parties gain an additional 2-4% of the vote share in elections with term limits.

In the traditional Downsian model (Downs (1957)) politicians are strict vote maximizers. Politicians thus pick the policy position that will satisfy a majority of their constituents. The result is that both candidates in an election with a single issue space align themselves at the same point in the policy space, each capturing half of the votes. However important the Downsian model has been for understanding politics, the assumption that politicians do not care about the policy implemented stretches reality in a way that can create a great divide between public choice theory and

[1]Examples of such incentives include campaign contributions, political appointments, aid in passing legislation, and other pecuniary and non-pecuniary benefits to the politician or his family.

empirical observation. In particular, introducing politicians' preferences over policy creates a time consistency problem. A politician may want to espouse a particular platform in order to increases his chances of winning an election, but once elected, the politician will have an incentive to shirk and follow his own policy preferences. There is a tension between the policy the politician wants to campaign on and the policy he wants to enact once in office.

In a world with fully informed, rational, forward-looking voters, a politician's desire to shirk will be accounted for when the voting decision is made. If politicians can be elected to only one term in office, forward looking voters (foreseeing this shirking) will not believe any promises by the politician about a policy other than the politician's own most preferred policy. In this environment, politicians will announce their most preferred policy as their platform and each voter will vote for the politician with the platform nearest his own policy bliss-point. There is no convergence in the positions of the two candidates as there is in the typical Downsian model.

Using reputational mechanisms in an infinitely repeated game setting, policies other than that which is most preferred by the politician can be made time consistent. Alesina (1988a) models political parties playing an infinitely repeated game and applies the Folk Theorem of repeated games to show that full or partial policy convergence is possible (depending on the parties' rate of time preference) even when the parties do not have the ability to make binding pre-commitments. The intuition for this is that by deviating from the announced policy (i.e. shirking) a politician

(party) loses the ability to credibly commit to anything but his (its) most preferred policy in all elections thereafter. Since being able to make credible commitments to a broader range of policies increases electoral success, a politician (party) can be induced to not shirk.

In a finite setting (that is when the last period of the politician is known with certainty) a transfer scheme such as that presented in Alesina (1988b) can be used. Here, utility transfers [2] are made from a "vice president" to a "president" in order for the president to not shirk in his last term. Shirking by the president lowers the chances that the vice president is elected to the presidency in the following election. The vice president's electoral success suffers because of the damage to the reputation of the party, which he shares with the president. If the president shirks, voters will not believe the campaign promises of the vice president unless those promises are the vice president's most preferred position. The overlapping generations of party members encourages transfers to the current president to persuade him not to shirk and since the president does not shirk, the reputation of the party is kept alive benefiting the vice president in his campaign for presidency.

I proceed as follows. Section 2 introduces my theoretical model and discusses its implications. Section 3 describes the data. Section 4 presents the reduced form model I will use to test the implications of the theoretical model. Section 5 presents the results, and Section 6 concludes.

[2]For the rest of the paper, I will use the terms transfers and incentives interchangeably. Again, these include anything that an organized party may give to a politician to influence his behavior.

3.1 Theoretical Model

3.1.1 Informal Description of the Model

Both parties and politicians care about policy outcomes leading to time inconsistent policy platforms. I assume that parties have the preferred policy of their representative member (i.e. all party members have the same preferred policy). [3] Parties are relatively long lived compared to individual politicians. Whenever the two parties have preferred policies that differ, each has an incentive to announce a policy that is closer to the opposing parties position to capture, probabilistically, more voters. With repeated interaction and a two party system, the policies of the two parties will converge (although perhaps not fully) and reputational effects make the converged policies time consistent.

Individual politicians have platforms that tend to converge to that of their challengers' in a similar manner. However, due to the shorter careers of politicians, the party would like to adopt a policy that is much closer to that of the opposing party than is time consistent for the individual politician to adopt when facing a member of the opposing party. Individual politicians and the party would like to

[3] This is a simplification, but highlights the fact that parties are important in pre-commitment even if all the members have the same preferred policy. This different than the way parties act to pre-commit politicians in Levy (2004) where bargaining over a multi-dimensional policy space is needed for parties to be able to pre-commit politicians. The assumption that the party and its representative members have the same preferences is not necessary for the qualitative results. These results hold so long as whatever function the party uses to select its policy position does not result in the party choosing "too extreme" of a position. A position that is "too extreme" is a position that is so far from the center that the party (even with its higher rate of time preference) could not credibly commit to a position that is more moderate than that which an individual party member could commit too. In such a case, there would be no role for parties in the model presented.

offer a policy that is as close to the challengers as possible [4], but because voters are rational and forward looking, politicians have to offer a policy that is time consistent. In order for the politicians to offer a time consistent policy that is closer to their challengers', parties make transfers to politicians after they have implemented a policy. If politicians do not implement the policy the party would like, they get no transfer. In this way, parties allow politicians to increase the space of policies that are time consistent. This enables politicians to credibly announce policies that increase their chances for electoral success, benefitting both themselves and their parties. The size of these transfers will depend on how far the party's converged policy is from that of the politician, the rate of time preference for the politician, the preferences of the voters, and the value of a seat in office.

3.1.2 Formal Description of the Environment

I now provide a formal description of the environment described above. Most of what follows is presented in Alesina (1988a) and Alesina (1988b). Alesina (1988a) models the repeated interaction of parties, while Alesina (1988b) models finitely lived politicians in an overlapping generations framework. I put elements of both models together. Like Alesina (1988a), I use the Folk Theorem of repeated games to get policy convergence, but allow politicians as well as parties to be modeled as playing an infinitely repeated game. Because the last period of the politician's career is not known, it is natural to model his career as having an infinite horizon, with the rate of

[4] A politician (party) will never choose policy such that the challenger's policy is between the preferred policy of the politician (party) and the politician's (party's) most preferred policy

time preference and the probability of running in the next election weighting future campaigns for office. From Alesina (1988b), I take the transfer scheme that helps to achieve policy convergence in the finite setting, but have transfers coming from the parties rather than individual politicians. I also allow transfers in the infinite horizon setting.

Preferences of candidates and parties. Politicians have a bliss point in the policy space $x^b, y^b \in [0,1]$. Let x^b be the bliss point for candidates from Party 1 and y^b be the bliss point for candidates from Party 2 and let $x^b > y^b$. Let the utility from realized policy position z be $U(z)$ and assume that U is the same for both parties [5]. U has the following properties:

- $U'(z^b) = 0$
- $U'(z) \geq (\leq) 0$, if $z \leq (\geq) z^b$
- $U''(z) < 0 \forall z$

Candidates from each party have a bliss point in the policy space and their utility is decreasing as they get farther from that point. Candidates also realize a benefit to holding office unrelated to the policy they implement, given by k. The weight placed on the utility from a policy is given by α. Note that the use of α allows for the Downsian case as a specific example. If $\alpha = 0$ then the candidate

[5]The assumption that candidates from both parties have the same utility function could be generalized and does effect the amount of policy convergence, but it is not important for the qualitative implication of the model that I test.

only cares about holding office and we are in the Downsian case where credibility is not a concern since politicians care only about a seat in office and not policy *per se*. Politicians' rate of time preference and survival rate are integrated into the parameter $\delta < 1$. I assume that the preferences of the party are identical to that of the politicians in that party, but parties have a different rate survival and time preference given by β. [6] Party level preferences can be thought of as the party's platorm. There is some social choice function within the party that aggregates the preferences of all its members, from which I abstract. In the multidimensional policy environment, Levy (2004) provides an example of the setting of party platforms in a dynamic setting. It is assumed that $\beta > \delta$ since political parties tend to have a longer life than political candidates. The assumption of identical preferences between the party and its members over policy and holding office is overly restrictive since it is only necessary that the party have a rate of time preference high enough that in a repeated game the party can have a time consistent policy that is more moderate than that of individual politicians of that party. I make the assumption to simplify the analysis, but what is important is the hold moderate (i.e. how close to the other party) can a time consistent policy be. If the party has preferences that are more extreme than the politician, it must be the case that the rate of time preference for the party be sufficiently large that it can credibly commit to a more moderate policy. If the party's preferences are more moderate, the time preference parameter need not be so large.

[6]For the rest of the paper I will call β and δ rates of time preference. While not pure rates of time preference since they incorporate the survival rate of parties and candidates, they do reflect how future campaigns are discounted.

Preferences of the voters. Voters are defined by a function $P_t = P(x_t^e, y_t^e)$, where P_t the probability that Party 1 will be successful in period t given voter expectations of candidate policy, x_t^e, y_t^e . I assume that P has the following properties:

- $P_t(\cdot)$ is time invariant and common knowledge.
- $0 \leq P \leq 1$ for all $x^e, y^e \in I$, where $I = [0, 1]$. $0 < P < 1$ for all $(x^e, y^e) \in B$, where $B = \{(x, y) \in I \times I | y^b \leq y \leq x \leq x^b\}$
- $P(x_t^e, y_t^e)$ is twice continuously differentiable for all (x_t^e, y_t^e) except, possibly, at $x_t^e = y_t^e$.
- $\partial P(\cdot)/\partial x_t^e \equiv P_1 > (<)0$ if and only if $x_t^e < (>) y_t^e$; $\partial P(\cdot)/\partial y_t^e \equiv P_2 > (\leq)0$ if and only if $x_t^e \leq (>) y_t^e$ [7]

Alesina and Cukierman (1987) derive a probability function with the above properties from the underlying preferences of voters. Voters vote for the candidate with the expected policy closest to their bliss point, but there is uncertainty about the distribution of these preferences and about the number of voters that turnout, which results in the politicians viewing the election in a probabilistic manner.

Information. The bliss points of politicians and parties, x^b, y^b and $U(\cdot), \delta, \beta\, k,$, and α are common knowledge. There is uncertainly about the distribution of voter preferences, but the beliefs about this distribution are common knowledge (i.e. all candidates, parties, voters know $P(\cdot, \cdot)$).

[7] Assume $P_1(x, x) = P_2(x, x) = 0$ if the function $P(\cdot)$ is differentiable on the diagonal.

Transfers. Each period, the party may make a utility transfer to the politician if he has followed a specified policy. Let the transfer be defined by the function $g(x)$.

Beliefs. Politicians believe that if the transfers were not given for some period in the past by a particular party, they will not be given again by that party. If transfers were always made, they will be made again if the specified policy is followed. If a politician deviates from his announced policy then voters will expect the politician (party) to follow his (its) most preferred policy in the future. Cooperation between the candidates/parties is broken and the game reverts to the one-shot Nash equilibrium [8]. That is in every election after $x \neq x^a$ or $y \neq y^a$ voters have $x^e = x^b$ and $y^e = y^b$.

Timing. The timing of the model is as follows for each election cycle. First, candidates/parties simultaneously announce platforms x_t^a, y_t^a. Next, elections take place and Party 1 wins with probability $P(x_t^e, y_t^e)$. Once in office, a politician implements a particular policy, x_t or y_t. If the policy is that which was announced by the party, the politician gets a transfer $g(x)$. It is very important that this transfer be made after the politician has carried out the policy. If the transfer comes before the politician does so, the transfer does not help solve the time consistency problem. The politician will take the transfer and then implement his most preferred policy.

[8]The length of the non-cooperation period is not important qualitatively, but would effect the location of the policies selected. I am not sure if I need that both politicians/parties are trusted in the future. It seems like a separate penalty on each party would suffice to keep them in line.

3.1.3 The Party's Problem

Parties are thought of as relatively long lived organizations. I model them as infinitely lived organizations as in Alesina (1988a), but allow them to make transfers to their members as done in Alesina (1988b). Two parties compete in an infinitely repeated game. In each election cycle, parties announce a platform then elections are held. After elections, the party implements a policy. Voters are rational and forward looking and have expectations about the policies to be implemented. Call Party 1's policy x and Party 2's policy y. The expected policies are x^e and y^e. Rational expectations implies that in equilibrium the expected policies will be those implemented. In the following models, I impose the restriction that $x = x^e$ and $y = y^e$. I describe only the problem for Party 1, but Party 2's problem is symmetric. Since the parties act simultaneously, the equilibrium concept used is a Nash Equilibrium so each party takes the other party's actions as exogenous when choosing its policy position. Party 1 solves:

$$max_x\ v = P(x,y)[\alpha(U(x) - g(x)) + (1-\alpha)k] + (1 - P(x,y))[\alpha U(y)] + \beta v_1 \quad (3.1)$$

subject to:

$$v \geq P(x,y)[\alpha U(x') + (1-\alpha)k] + (1 - P(x,y))[\alpha U(y)] + \beta v_2 \ \ \forall x' \in X \quad (3.2)$$

Where v_1 is the continuation value if a politician of the party does not deviate from its announced policy.

$$v_1 = \frac{P(x,y)[\alpha(U(x) - g(x)) + (1-\alpha)k] + (1 - P(x,y))[\alpha U(y)]}{(1-\beta)} \quad (3.3)$$

And v_2 is the continuation value if a politician of the party does make a deviation from its announced policy.

$$v_2 = \frac{P(x^b, y)[\alpha U(x^b) + (1-\alpha)k] + (1 - P(x^b, y))[\alpha U(y)]}{(1-\beta)} \tag{3.4}$$

Substituting in the constraint and rearranging, I can write the following:

$$[\alpha U(x) - \alpha g(x) + (1-\alpha)k - \alpha U(y)] \geq (1 - \beta - \beta \frac{P(x^b, y)}{P(x, y)})[\alpha U(x^b) + (1-\alpha)k - \alpha U(y)] \tag{3.5}$$

Applying the Implicit Function Theorem to Equation 3.5, I get the following equation for $\frac{\partial x}{\partial \beta}$:

$$\frac{\partial x}{\partial \beta} = -\frac{(1 + \frac{P(x^b,y)}{P(x,y)})[\alpha U(x^b) + (1-\alpha)k - \alpha U(y)]}{\alpha \frac{\partial U(x)}{\partial x} - \alpha \frac{\partial g(x)}{\partial x} - \beta \frac{P(x^b,y)}{P(x,y)^2} \frac{\partial P(x,y)}{\partial x})[\alpha U(x^b) + (1-\alpha)k - \alpha U(y)]} \tag{3.6}$$

Since I've assumed that $x^b > y^b$ the sign of $\frac{\partial x}{\partial \beta}$ is negative. Thus as the rate of time preference increases (i.e. the expected life of the party increases) the constraint gets looser and thus x gets farther from x^b. Although the party has a preferred policy position, it is willing to compromise on this for electoral success. Indeed, even if the value of a seat in office, k, is equal to zero, the party will still want to move its policy position to capture more votes. The longer the time horizon of the party, the more the party cares about future electoral success and thus the more it can move its policy about from its most preferred. Having party specific parameters does not change the qualitative results that parties with longer time horizons can credibly commit to policies further from their bliss point, but will affect the location of policies chosen in equilibrium. Politicians solve a similar problem which I model next.

3.1.4 The Politician's Problem

3.1.4.1 The Finite Electoral Game

I use a two period problem to find the value of transfers that will be needed in the finite game. No matter the length of the game, the last period determines the size of the transfer so the two period problem extends to an N period problem without loss of generality.

At the start of his career a politician from Party 1 solves the following problem in the face of term limits:

$$max_x\ v = P(x,y)V(x,k)+(1-P(x,y))[\alpha U(y)]+\delta\{P(x,y)V(x,k)+(1-P(x,y))[\alpha U(y)]\} \tag{3.7}$$

subject to: $U(x) + g(x) \geq U(x^b)$

where $V(x,k) = [\alpha(U(x) + g(x)) + (1-\alpha)k]$

The incentive compatibility constraint says that a transfer must make the politician at least as well off as if he implemented his optimal policy in the last period. This is the best one shot deviation and thus if there is no incentive to shirk in this period, there will not be shirking in other periods. Without the transfer, the politician will always implement his best policy in his last term. Forward looking, rational voters will expect this behavior and so the politician will not be able to credibly commit to anything but his most preferred policy x^b. That this constraint gives us a unique

value for $g(x)$ and that this constraint is the same for a finite game of any length, it is clear that any finite game will require the same size transfer in order to prevent shirking. The value for $g(x)$ in a finite game is thus $g(x) = U(x^b) - U(x)$ for any $\alpha > 0$.

3.1.4.2 The Infinitely Repeated Electoral Game

In the absence of term limits, voters do not know with certainty the last period of the politician. In this case, a potential politician solves the following problem at the beginning of his career:

$$max_x\ v = P(x,y)[\alpha(U(x) + g(x)) + (1-\alpha)k] + (1 - P(x,y))[\alpha U(y)] + \delta v_1 \quad (3.8)$$

subject to:

$$v \geq P(x,y)[\alpha U(x') + (1-\alpha)k] + (1 - P(x,y))[\alpha U(y)] + \delta v_2 \ \ \forall x' \in X \quad (3.9)$$

Where v_1 is the continuation value if the politician does not deviate from his announced policy.

$$v_1 = \frac{P(x,y)[\alpha(U(x) + g(x)) + (1-\alpha)k] + (1 - P(x,y))[\alpha U(y)]}{(1-\delta)} \quad (3.10)$$

And v_2 is the continuation value if the politician does make a deviation from his announced policy.

$$v_2 = \frac{P(x^b,y)[\alpha U(x^b) + (1-\alpha)k] + (1 - P(x^b,y))[\alpha U(y)]}{(1-\delta)} \quad (3.11)$$

By definition, the best policy a politician can choose is x^b, thus $x' = x^b$. Given this, I can substitute the constraint into the objective function and solve for the function $g(x)$. Substitution and some algebra results in:

$$g(x) = \delta[(\frac{P(x^b, y)}{P(x, y)} - 1)((\frac{1-\alpha}{\alpha})k + U(x^b) - U(y))] + U(x^b) - U(x) \tag{3.12}$$

Because $P(x^b, y) < P(x, y)$ for any $x \neq x^b$ the politician would choose it is apparent that $g(x)$ is decreasing in δ and reaches its maximum at $\delta = 0$. In fact, at $\delta = 0$, $g(x) = U(x^b) - U(x)$. This means that transfers from the parties must be largest in the face of term limits (when $\delta = 0$ at some known time) holding constant the value of a seat in office, k. Larger transfers allow the politician to credibly commit to a policy farther from his bliss point and thus capture more votes. To the extent that larger parties are more able to provide larger transfers, one should find larger parties gain an advantage in the face of term limits. This is the implication for the model that I choose to test. The next section will discuss how I do so [9].

While the commitment problem of politicians is highlighted in the finite game, even in the the infinitely repeated game it is unlikely the politician will be able to credibly commit to an x far from x^b in the absence of transfers from the party. The reason is that one should not expect the politicians rate of time preference to

[9] I am unable to observe the transfers that model incorporates. As noted previously, such transfers can take many forms, most of which, such as help in attaining other political office, are hard to observe. In a unique dataset, Lott (1990) finds evidence that employment after a political career, either for the politician or his family, helps to reduce the lame duck problem.

be very high relative to the party's. Even the best political families have lives that are much shorter than those of the parties they belong to. If parties have the same preferences as the politicians that join them, the policy the party can credibly commit to is much closer to the policy of the competing party than the policy the politician can credibly commit to. Thus parties have a great incentive to make these transfers to the politicians: it helps politicians win office and motivates them to the incentive to carry out a policy close to the party's ideal point. Politicians benefit from the transfer and from the ability to credibly commit to a policy closer to the challengers, thus capturing more votes.

3.2 Data

State gubernatorial races provide an excellent data set to test the hypothesis that larger parties fair better when time consistency problems are more severe.

The variation in when and if states have instituted term limits on their governors is large. Thirty-six of the 50 states have term limits in place. Of these 36, 26 of them have instituted term limits some time after 1950, and 18 have adopted term limits since 1977, the beginning of my sample period. Table 3.1 provides a list of which states have term limits and the year of approval. Also included is whether or not the state had term limits on their U.S. Congressmen that were repealed with the *US Term Limits v. Thornton* ruling in 1995. The variation in the adoption of term limitation provides the best data to estimate the effects of term limits on party vote share. Other elected offices, have some of the following drawbacks: the U.S. Congress does not have term limits, the Presidency lacks observations and variation

and state legislatures did not begin adopting term limits until very recently (the vast majority in 1992 or later), so it would be difficult to control for intertemporal trends in popularity of the two major parties. [10]

Gubernatorial election data was collected by Jensen and Beyle (2003), and includes both election outcomes and detailed data on campaign expenditures. Data on presidential elections is from the Inter-university Consortium for Political and Social Research Study No. 13, "General Election Data for the United States, 1950-1990" and from the Federal Election Commission. Information about term limits for state governors comes from the interest group US Term Limits. In seven states that have term limits, candidates are allowed to run again after taking a term (or two) off. [11] Since term limits in the model are those that are lifetime term limits (i.e. you get a limited number of terms to serve in your lifetime) I code these seven states as not having term limits. Dropping these seven states from the sample or coding them as having lifetime term limits, leaves the results largely unaffected.

I focus my investigation on the effects of term limits on the vote share of candidates from the two major parties as compared to those from of third parties. The two major parties (the Democrats and Republicans in the era of this study) are those that would most easily have an effect on credibility of the politicians. [12]

[10] Trends in popularity for particular parties may arise due to the current popularity of particular policy issues, political scandals, or extraordinary political successes.

[11] These states are Indiana, Montana, North Carolina, Ohio, Virginia, Wyoming, and Utah.

[12] Minnesota's Democratic Farm Labor party is considered part of the Democratic party. For the time period 1975-1995, the Independent Republicans of Minnesota are labeled as Republicans since

Table 3.1: State Gubernatorial Term Limits

State	Year Approved	Term Limits on U.S. Congress
Alabama	1968	
Alaska	1959	Yes
Arizona	1992	Yes
Arkansas	1992	Yes
California	1990	Yes
Colorado	1990	Yes
Connecticut	-	
Delaware	1787	
Florida	1992	Yes
Georgia	1976	
Hawaii	1978	
Idaho	-	
Illinois	-	
Indiana	1851	
Iowa	-	
Kansas	1972	
Kentucky	1992	
Louisiana	1812	Yes
Maine	1993	Yes
Maryland	1947	Yes
Massachusetts	-	Yes
Michigan	1992	Yes
Minnesota	-	
Mississippi	1890	
Missouri	1821	Yes
Montana	1992	Yes
Nebraska	1966	Yes
Nevada	1970	Yes
New Hampshire	-	Yes
New Jersey	1844	
New Mexico	1986	
New York	-	
North Carolina	1977	
North Dakota	-	Yes
Ohio	1992	Yes
Oklahoma	1966	Yes
Oregon	-	
Pennsylvania	1874	
Rhode Island	1992	
South Carolina	1980	
South Dakota	1972	Yes
Tennessee	1978	
Texas	-	
Utah	1994	
Vermont	-	
Virginia	1851	
Washington	-	Yes
West Virginia	1872	
Wisconsin	-	
Wyoming	1992	Yes

Because they have more resources available to them, these parties can more easily provide the larger transfers needed to make a more moderate policy time consistent for politicians. Furthermore, they are the parties that are seen as more stable and as lasting farther into the future meaning their time horizon is longer Due to the longer time horizon of these parties, even holding the size of transfers constant, they can credibly commit to a more moderate policy than smaller parties. Since candidates from the larger parties can credibly commit to policies farther from their bliss point, all else equal they can capture more of the vote share in an election. This advantage will grow under term limits because of the increase in the size of the transfer needed to make a given policy time consistent. A resulting increase in vote share of the major parties should be expected, if the model presented in Section 2 is correct.

Demographic and economic control variables come from the Current Population Survey (CPS). From the survey I take measures of the the populations age, racial and ethnic composition, percent married, and percent female. To control for economic factors, I gather data on the fraction of the populace with a college degree, the average income for the state, the coefficient of variation of income, and the unemployment rate, and the percent of workers employed by the government.

Table 3.2 presents summary statistics regarding the vote share variables.

they were considered to be a party of the national Republican Party. Similarly, corrections are made for those running as liberals and conservatives as well as under the major party labels in New York's gubernatorial races. Such changes are to capture the true party of membership and avoid regional labels. These changes actually make the hypothesis harder to prove since both New York and Minnesota lack term limits.

Table 3.2: Summary Statistics for Vote Share Variables

Vote Share of:	Obs	Mean	Std. Dev.	Max	No. of Wins
Two Major Parties	367	96.195	8.007	100	362
Republicans	367	47.283	11.064	75	175
Democrats	367	48.919	11.472	82	187
Third Parties	367	3.586	8.043	70	5

There are 370 gubernatorial elections from 1977-2004. Each state is observed a minimum of seven times and a maximum of 14 times. I drop three elections from the sample because data on campaign expenditures were missing and unavailable [13]. Clearly, the two major parties perform much better than third parties. The means for the two major parties individually are also remarkably close together suggesting that they are very competitive with each other, while third parties are not serious contenders. In only 5 of the 370 elections since 1977 did a third party candidate win. On average, the two major parties account for about 96% of the votes. Of the 367 elections in the sample, Republicans won 175, Democrats won 187, and third parties won 5.

3.3 Econometric Model

To see the role of political parties in solving time consistency problems, I test whether or not larger parties have an advantage under term limits. The model estimated is the following:

$$V_{it} = \alpha TL_{it} + \gamma P_{it} + \beta X_{it} + \delta_{it} + \nu_{it} + \epsilon_{it} \tag{3.13}$$

[13]These elections are Arkansas's 1984 race, won by a Democrat, Montana's 1996 race, won by a Republican, and West Virginia's 1984 race, won by a a Democrat.

The subscripts i and t refer to the election state and year, respectively. V is the vote share of the party (or parties) of interest in the general election. All third parties are grouped together and fall under the third party label. Depending on the specification, I may put the vote shares of the two major parties (the Democrats and Republicans) together. TL is a dummy that equals one if there are term limits for the office contested in the election. P is a vector of political control variables that includes dummies for incumbent candidates from the Democrat, Republican and third parties, share money spent by the candidates, dummies indicating the candidate is a sitting Lieutenant Governor, closeness of the election, and vote share of the two major parties in the most recent presidential election. Closeness of the election is measured by the absolute value of the difference in vote share between the Republican and Democratic candidate. If they both have the same vote share, the closeness = 0 and it increases as the distance between the two parties increases. The closeness term is intended to capture the effect of voters not wanting to "waste" their vote on a third party candidate. X is a vector of economic and demographic control variables. Included in X are average age, percent black, percent other non-white races, percent hispanic, percent married, percent female, percent of the population with a college degree, average log income for the state, the unemployment rate, percent of workers employed by the government, and the coefficient of variation of income. δ and ν are region and time fixed effects, respectively. Regional fixed effects are meant to account for time-invariant regional party preferences. Time effects control for national trends in party popularity over-time. The portion of vote share not explained by the covariates is given by ϵ. The time fixed effects break the 1977-2004 period into seven

periods. For each period, I have four years of election data, thus each period has each state represented one (or two) times depending on whether or not a term is two or four years. [14] Controlling for the time period helps to capture trends in national party popularity over time, but are not biased by the group of states voting in a particular year as year fixed effects would be. The model is estimated using robust standard errors in case of heteroskedasticity of the error term.

The theoretical model predicted that transfers to politicians need to be larger in the face of term limits, holding constant the policy position. Such a change in electoral rules, therefore, may confer advantages to larger parties who can more easily make large transfers. Under the assumption that larger parties have such an advantage due to factors including larger membership and more room for upward mobility within the party, the above specification provides a test of the ability of parties to commit politicians to platforms that would not otherwise be time consistent. Vote share should increase with increases ability to commit politicians, all else equal, since a more moderate platform is closer to the prefence of the median voter. The hypothesis under examination is that political parties act as a commitment technology. The test is to see whether the vote share of candidates from major parties increases after the imposition of term limits, which is consistent with the theoretical model presented in Section 2. Term limits provide a natural test of the role of parties as a commitment technology because term limits have a clear effect on the time consistency of candidate platforms but little effect on the other cited roles of political parties. The value

[14] Only New Hampshire and Vermont still have two-year terms, but for portions of my sample period, Arkansas (1977-1986) and Rhode Island (1977-1994) also have two-year terms.

of parties as bodies to increase voter turnout or to fund campaigns remains largely unchanged after term limits. [15] [16]

Much of the support of term limits stems from wanting to increase political competitiveness. Thus if particular parties are very successful, it may affect the probability term limits will be instituted. Due to the potential endogeneity of term limits to the success of the parties, I also estimate an instrumental variables model. In the instrumental variables version of Equation 3.13 the term limits dummy is instrumented for using a dummy variable indicating whether or U.S. Congressmen were term limited by the state prior to *US Term Limits v. Thornton* (1995). In order for these to be good instruments, they must be correlated with term limits and uncorrelated with the success of parties in gubernatorial races. Regressing the term limits dummy on the instruments shows that there is a strong correlation. The system is perfectly identified, therefore I cannot test whether term limits on Congressmen are uncorrelated with vote shares of gubernatorial candidates, but there is no *a priori* reason why the two should be correlated.

[15] One might argue that the role of parties as providers of information on politicians might increase since there are less incumbents running when term limits are present. The specification above controls for incumbency in hopes of controlling for this role parties may play.

[16] There is some evidence that funding for campaigns in is smaller when the seat contested is term limited. For empirical evidence of this one can see Daniel and Jr. (1997). So in fact, the importance of parties as a source of funding may, in fact, decrease after the imposition of term limits, working against the results that strong parties become more important due to their relative advantage in time consistency issues.

3.4 Results

The results of estimating Equation 3.13 are presented in Table 3.3. I estimate the equation using the vote share of the two major parties together, Republicans, Democrats, and third parties as dependent variables. Coefficients for the term limits dummy and the political variables are presented. I do not report the coefficients on the economic and demographic variables or the regional and time fixed effects. All the incumbency and money variables have the expected sign, with the exception of the third party incumbency coefficient. Although this shows a negative relation, the term is small and insignificant. In fact, there are only three third party incumbents in this sample, so this coefficient should be interpreted with caution. The magnitude of the incumbency advantage is consistent with the measures found in empirical studies of the incumbency advantage in Congress, for example Levitt and Wolfram (1997). Term limits are only statistically significant in the regressions where the dependent variable is that of the two major parties or of third parties. The coefficient on the term limits dummy indicates that third party candidates see an increase of about one percentage point in the vote share they receive when term limits are in place. My model's prediction of a decrease in vote share by third party candidates is not supported by the OLS results. Using a differences in differences approach gives similar results. Both methods are likely to be biased since there is good reason to believe that the adoption of term limits in not exogenous.

An oft cited argument in favor of term limits is that it is difficult to get those in power out of office. It is thus reasonable to expect preferences for term limits

to be stronger in states which have had their governor's office controlled by a single party. Given that the two major parties have held the vast majority of governorships, the expected effect is a downward bias on the term limits coefficients in the OLS regressions of Democratic and Republican votes share. Along with this is an upward bias of the effect of term limitation on third parties. Table 3.4 presents the results of an instrumental variables approach that corrects for this bias[17]. The size of the coefficient increases for the two major parties together and for each separately. For third parties, the coefficient decreases as expected.

Term limits have an even larger effect in the instrumental variables models. Democrats gain almost three percent of the vote share and third parties lose almost seven percent. The effects of term limits are quantitatively significant. To see this, note that the incumbency advantage is only about 50% larger than the effect of term limits on each of the two major parties. The incumbency advantage is often cited as a large barrier to entry in electoral competition and is a prominent reason many favor term limits. Incumbency might benefit both the party and the politician himself. [18] Another way to see the quantitative significance of the effect of term limits is to note

[17] A Hausman exogeneity test finds that term limits are marginally endogenous (at the 11% level).

[18] The measure of incumbency used here captures both advantages to oneself of holding a governorship and well as advantages to one's party of of having a member that is a sitting governor. What the coefficient on the incumbency term captures (the incumbency advantage given to a particular candidate) is likely much higher than a measure of the advantage of having just any party member in office and not the particular candidate. In addition, the measure of incumbency advantage is likely to be biased upward since I have no control for the candidate's ability. Good politicians are likely to get into office and stay there, not just because they have the incumbency advantage, but because they are better politicians to begin with. Given this, the incumbency advantage might be much closer to the advantage gained from term limits.

that Democrats would have to spend and additional 21 percentage points of the total money spent in the election to gain an advantage as large as they gain through the imposition of term limits [19].

The significance of the effect of term limits can also be seen in electoral outcomes. Using the point estimates on the effect of term limits, I find that had term limits not be instituted, seven elections would have had different outcomes. Third parties would have won an additional governorship (Hawaii, 1994). Democrats, due to their relative disadvantage under term limits, would have picked up an additional six wins had term limits not be in place.

3.5 Conclusion

By making the last period of an elected official's career certain, term limits take away an individual politician's ability to use his own reputation to credibly commit to a policy that is not his most preferred. In doing so, the relative advantage to joining a political party increases. If the ability of the party to increase the space of credible policies is related to the size of the transfers it can make to politicians, larger parties will be able to support politicians with credible policies farther from the politician's bliss point. Being able to credibly commit to a broader range of platforms increases the chances of the politician winning the election and results in an advantage to larger parties under term limits. The effect of term limits on party

[19]The increase in spending to equal the benefit of term limits may seem large, but the result is consistent with Levitt (1994) who finds little effect of campaign spending on vote share.

vote share in gubernatorial elections is large, equal to two thirds of the incumbency advantage for both Democrats and Republicans. If term limits are meant to increase the democratic expression (Elhauge, Lott, and Manning (1997)) of voters, then to the extent that candidates from the major parties share beliefs with others in the party, term limits do not succeed.

By reducing the role of a politician's reputation, term limits affect not only election outcomes, but the choice of policy. While policy choices are not the focus of this paper, Besley and Case (1995) show that state gubernatorial term limits increase spending and taxes in the final term because of the loss of reputational effects. Evidenced here is the need for parties to act as mechanisms that substitute for the role of a politician's reputation in the case where terms are limited. It would be ideal to examine how policy variables change when a member of a third party is the governor. While there are not enough third party candidates winning governorships to test this, the indirect approach taken in this paper provides some evidence to this counter factual. Given that voters do care about policy outcomes and have some rationality and forward looking ability, the changes in vote shares when term limits are present is an indicator that third party governors would have had even worse policy outcomes.

The results of this paper not only shed light on the importance of political parties in solving time consistency problems, but also have implications for the discussion of term limits. Elhauge, Lott, and Manning (1997) argue that term limits

promote democratic expression for two reasons. First, they lower barriers to entry by reducing the incumbency advantage. Second, term limits help solve the collective action problem of relative seniority. Only the first objection applies to state gubernatorial term limits, as the second has to do with district specific transfers in a legislature. Elhauge, Lott, and Manning (1997) do caution that the lame duck problem will be more severe under term limits, but provide some arguments why that might not be a significant problem. The contribution of this paper towards the term limits literature is to quantify the effect of the lame duck problem caused by term limits. The incumbency advantage is a barrier to entry that may reduce welfare, but when measured by vote share, the lame duck (i.e. time consistency problems) are very important as well, suggesting that a substantial portion of the benefit of term limits is offset.

Table 3.3: Results from OLS Regressions

Vote Share of:	Two Major Parties	Republicans	Democrats	Third Parties
Term Limits	-1.090**	-0.517	-0.566	1.043*
	(0.535)	(0.921)	(0.925)	(0.537)
Democratic Incumbent	-0.174	-4.439***	4.268***	-0.167
	(0.598)	(1.123)	(1.128)	(0.580)
Republican Incumbent	0.876	6.135***	-5.248***	-0.813
	(0.743)	(1.352)	(1.312)	(0.736)
Third Party Incumbent	0.324	-5.794	6.104	-0.735
	(4.710)	(4.958)	(4.147)	(4.586)
Democratic Governor	2.176	3.930	-1.769	-2.085
	(5.455)	(3.586)	(3.487)	(5.477)
Republican Governor	1.989	3.227	-1.252	-2.160
	(5.465)	(3.645)	(3.536)	(5.482)
Republican % Money	0.731***	0.427***	0.304***	-0.741***
	(0.095)	(0.065)	(0.078)	(0.095)
Democratic % Money	0.736***	0.152**	0.585***	-0.748***
	(0.098)	(0.062)	(0.081)	(0.098)
Lt. Gov. Democrat	0.473	-0.930	1.397	-0.356
	(0.631)	(1.301)	(1.227)	(0.620)
Lt. Gov. Republican	0.978	3.562**	-2.586*	-0.624
	(0.678)	(1.576)	(1.453)	(0.649)
Lt. Gov Third Party	-3.135	-2.151	-1.019	2.707
	(9.801)	(6.770)	(3.859)	(9.817)
Closeness of Election	-0.015	-0.073*	0.058	0.019
	(0.024)	(0.040)	(0.043)	(0.024)
Republican % Pres. Vote	0.082	-0.056	0.137	-0.087
	(0.084)	(0.192)	(0.167)	(0.085)
Democrat % Pres. Vote	0.115	-0.103	0.217	-0.121
	(0.085)	(0.189)	(0.168)	(0.084)
R^2	0.711	0.611	0.647	0.720
Observations	367	367	367	367

***, **, * mean the coefficient is significant at the 1%, 5%, and 10% levels, respectively. Standard deviations appear in parentheses below the estimated coefficients.

Table 3.4: Results from Instrumental Variables Regressions

Vote Share of:	Two Major Parties	Republicans	Democrats	Third Parties
Term Limits	6.845*	4.139	2.731	-6.759*
	(3.996)	(5.930)	(5.854)	(3.870)
Democratic Incumbent	0.786	-3.876***	4.666***	-1.111
	(0.971)	(1.419)	(1.415)	(0.933)
Republican Incumbent	1.147	6.294***	-5.135***	-1.079
	(0.988)	(1.437)	(1.308)	(0.976)
Third Party Incumbent	-0.925	-6.527	5.585	0.492
	(4.460)	(4.439)	(4.636)	(4.425)
Democratic Governor	5.045	5.614	-0.577	-4.906
	(6.126)	(4.364)	(4.084)	(6.135)
Republican Governor	4.746	4.845	-0.106	-4.871
	(6.075)	(4.424)	(4.099)	(6.083)
Republican % Money	0.698***	0.408***	0.290***	-0.708***
	(0.109)	(0.077)	(0.083)	(0.109)
Democratic % Money	0.695***	0.128*	0.567***	-0.707***
	(0.110)	(0.077)	(0.087)	(0.111)
Lt. Gov. Democrat	-0.272	-1.367	1.087	0.377
	(0.962)	(1.378)	(1.361)	(0.962)
Lt. Gov. Republican	2.114	4.229**	-2.114	-1.741
	(1.383)	(1.830)	(1.769)	(1.343)
Lt. Gov Third Party	1.435	0.530	0.880	-1.786
	(10.842)	(7.910)	(5.326)	(10.812)
Closeness of Election	0.053	-0.085**	0.050	0.039
	(0.108)	(0.043)	(0.046)	(0.030)
Republican % Pres. Vote	0.133	-0.072	0.125	-0.059
	(0.114)	(0.194)	(0.173)	(0.108)
Democrat % Pres. Vote	-0.036	-0.093	0.224	-0.139
	(0.030)	(0.194)	(0.171)	(0.113)
Observations	367	367	367	367

***, **, * mean the coefficient is significant at the 1%, 5%, and 10% levels, respectively.
Standard deviations appear in parentheses below the estimated coefficients.
Instrument is term limits on U.S. Congressmen
The R^2 statistic is not meaningful for IV models and therefore not reported.

Appendices

Appendix A

Chapter 1 Appendix

A.1 Details of Model Solution and Estimation

Given Θ, I approximate the AR(1) process for incumbent quality using the method of Tauchen (1986). The model is then solved using value function iteration (VFI). From the decision rules, I simulate 435 districts for 700 terms. When calculating the model moments, I use only the last 20 terms to avoid any effect of initial conditions. Thus the model moments are based on 8,700 observations.

The parameter vector, Θ, is updated using the derivative based approach of Lagarias, Reeds, Wright, and Wright (1998). To test the robustness of the minimization routine, a number of starting values were used. Results of estimation proved sensitive to starting values, so I conducted a search of the parameter space using both a brute-force approach and a simulated annealing algorithm (Goffe and Rogers (1994)). Once these methods narrowed down the space of parameters, I ran the estimation using the methods of Lagarias, Reeds, Wright, and Wright (1998) to find the minimum.

A.2 Full Tables of Results Not Reported in Text

Table A.1: Low Variation Programs, 1983-2006

CFDA Code(s)	Program Name
13.714, 93.778	Medical Assistance Program
13.773, 93.773	Medicare-Hospital Insurance
13.774, 93.774	Health Insurance for the Aged-Supplementary Medical Ins.
13.802, 93.802, 96.001	Social Security-Disability Insurance
13.803, 93.803, 96.002	Social Security-Retirement Insurance
13.805, 93.805, 96.004	Social Security-Survivors Insurance
13.807, 93.807, 96.006	Supplemental Security Income
14.156, 14.856	Lower-Income Housing Assistance Program
57.001	Social Insurance for Railroad Workers
64.101	Burial Expenses Allowance for Veterans
64.102	Compensation for Service-Connected Deaths for Veterans
64.104	Pension for Nonservice-Connected Disability for Veterans
64.105	Pension to Veterans Surviving Spouses, and Children
64.109	Veterans Compensation for Service-Connected Disability
64.110	Veterans Dependency and Indemnity Compensation
64.120	Post-Vietnam Era Veterans' Educational Assistance
64.104	Veterans Disability Pension
93.558	Temporary Assistance for Needy Families
93.600, 13.600	Child Development- Head Start
84.063	Pell Grant
93.020, 93.560	Family Support Payments to State Assistance Programs
93.563, 93.023, 13.783, 13.679	Child Support Enforcement
16.710	Public Safety and Community Policy Grants
84.04, 13.4782	Specials Services for Disadvantage Students
72.002, 94.002	Retired Senior Volunteers
21.3	State and Local Government Revenue Sharing
84.047	Upward Bound
13.808, 13.761, 13.780	Public Assistance-Maintenance Assistance (State Aid)

Table A.2: Probits to Determine Seniority-Re-election Relationship

Dependent Variable:	Incumbent Wins Election	
Model:	Naïve Model	Committee Model
Tenure in House/on Power Committee	0.018	0.021
	(0.013)	(0.019)
PAC Contrib. ($'s)	0.000	0.000
	(0.000)	(0.000)
Controlling Party	1.696***	1.649***
	(0.488)	(0.486)
% Change in State Income	-1.182	-0.986
	(2.476)	(2.475)
Comm. On Appropriations	0.328**	0.241
	(0.152)	(0.178)
Comm. On the Budget	0.490***	0.479***
	(0.185)	(0.185)
Comm. on Rules	0.298	0.325
	(0.297)	(0.297)
Comm. on Ways and Means	0.091	0.011
	(0.182)	(0.201)
Comm. on Agriculture	-0.080	-0.082
	(0.152)	(0.152)
Comm. on Armed Service	-0.071	-0.136
	(0.127)	(0.136)
Comm. on Natural Resources	0.008	-0.062
	(0.145)	(0.154)
Comm. on Merchant Marine and Fisheries	-0.025	-0.048
	(0.175)	(0.174)
Comm. on Transportation and Infrastructure	-0.116	-0.138
	(0.114)	(0.113)
Comm. on Science and Technology	0.042	0.019
	(0.133)	(0.132)
Comm. on Small Business	0.035	-0.029
	(0.140)	(0.142)
Comm. on Veteran's Affairs	0.178	0.160
	(0.166)	(0.165)
% Blue Collar*Democrat	0.040**	0.040**
	(0.018)	(0.018)
% Farm*Democrat	0.001	0.000
	(0.036)	(0.036)
Median Income*Democrat	0.000	0.000
	(0.000)	(0.000)
% Age $\geq$ 65*Democrat	0.026	0.027
	(0.018)	(0.018)
% Urban*Democrat	0.009***	0.009***
	(0.003)	(0.003)
% Blue Collar*Republican	-0.008	-0.009
	(0.023)	(0.023)
% Farm*Republican	-0.065	-0.065
	(0.042)	(0.042)

Table A.2: (continued)

Dependent Variable:	Incumbent Wins Election	
Model:	Naïve Model	Committee Model
Median Income*Republican	0.000**	0.000**
	(0.000)	(0.000)
% Age $\geq$ 65*Republican	-0.056*	-0.056*
	(0.029)	(0.029)
% Urban*Republican	-0.012**	-0.013**
	(0.005)	(0.005)
State*Party Controls	Yes	Yes
Congress Controls	Yes	Yes
Observations	3710	3710

Table A.3: Probability of Non-electoral Exit From Office by Tenure

Tenure	Prob. Retire
1	0.041
2	0.053
3	0.098
4	0.083
5	0.116
6	0.164
7	0.107
8	0.119
9	0.122
10	0.168
11	0.078
12	0.170
13	0.104
14	0.119
15	0.222

Table A.4: Probability of Obtaining a Seat on a Powerful Committee by Tenure

Tenure	Prob. Obtain Comm Seat
1	0.415
2	0.178
3	0.188
4	0.149
5	0.118
6	0.130
7	0.103
8	0.104
9	0.084
10	0.096
11	0.087
12	0.082
13	0.174
14	0.037
15	0.075

Table A.5: Probability of Retaining a Seat on a Powerful Committee by Tenure on a Powerful Committee

Tenure	Prob. Obtain
1	0.839
2	0.926
3	0.970
4	0.958
5	0.966
6	0.985
7	0.979
8	0.976
9	0.983
10	1.000
11	1.000
12	0.969
13	1.000
14	1.000
15	1.000

Table A.6: Outlays and Tenure Regression: Full Results for Naïve Model

Dependent Variable:	New Outlays Per Capita, High Variation Programs
Tenure	2.235
	(14.703)
Tenure^2	0.137
	(14.703)
Gen Elec %	-0.513
	(14.703)
PAC Contrib. ($'s)	0.001***
	(14.703)
Democrat	40.264
	(14.703)
Controlling Party Member	8.841
	(14.703)
Comm. on Appropriations Member	182.485***
	(14.703)
Comm. on the Budget Member	11.121
	(14.703)
Comm. on Rules Member	49.623
	(14.703)
Comm. on Ways and Means Member	34.305
	(14.703)
Committee on Agriculture Member	-15.621
	(14.703)
Comm. on Armed Service Member	64.190
	(14.703)
Comm. on Natural Resources Member	-24.845
	(14.703)
Comm. on Merchant Marine and Fisheries	4.601
	(14.703)
Comm. on Transportation and Infrastructure Member	50.768
	(14.703)
Comm. on Science and Technology Member	-40.362
	(14.703)
Comm. on Small Business Member	-58.004
	(14.703)
Comm. on Veteran's Affairs Member	11.283
	(14.703)
District Fixed Effects	Yes
Congress*State Controls	Yes
R-Squared	0.903
Observations	5216

Table A.7: Outlays and Tenure Regression: Full Results for Committee Model

Dependent Variable:	New Outlays Per Capita, High Variation Programs
Power Comm. Member	-60.605
	(14.703)
Power Comm. Tenure	59.249***
	(14.703)
Power Comm. Tenure^2	-3.866**
	(14.703)
Gen Elect %	-0.532
	(14.703)
PAC Contrib ($'s)	0.001***
	(14.703)
Democrat	37.669
	(14.703)
Controlling Party Member	9.856
	(14.703)
District Fixed Effects	Yes
Congress*State Controls	Yes
R-Squared	0.903
Observations	5216

Appendix B

Chapter 3 Appendix

Table B.1: Summary Statistics for Political Variables

Variabe	Mean	Std. Dev.
Term Limits	0.489	0.501
Democratic Incumbent	0.286	0.453
Republican Incumbent	0.265	0.442
Third Party Incumbent	0.008	0.090
Democratic Governor	0.549	0.498
Republican Governor	0.435	0.496
Republican % Money	48.158	19.671
Democrat % Money	49.567	20.034
Lt. Gov. Democrat	0.105	0.316
Lt. Gov. Republican	0.030	0.170
Lt. Gov. Third Party	0.008	0.090
Closeness	16.261	13.765
Democrat % Pres. Vote	49.885	9.193
Republican % Pres. Vote	43.170	7.937

Table B.2: Summary Statistics for Socio-economic Variables

Variabe	Mean	Std. Dev.
Log Median Income	0.282	0.194
Average Age	44.006	1.684
% Black	7.904	8.344
% Hispanic	6.412	9.351
% Other Races	3.891	9.120
Unemp. Rate	3.573	1.777
% Married	0.648	0.036
% Female	52.733	1.358
% College Educated	12.326	3.451
% Gov't Employees	10.886	2.548
Coef. Var. of Income	110.297	14.039

Table B.3: Full Results from OLS Regressions

Vote Share of:	Two Major Parties	Republicans	Democrats	Third Parties
Term Limits	-1.090**	-0.517	-0.566	1.043*
	(0.535)	(0.921)	(0.925)	(0.537)
Democratic Incumbent	-0.174	-4.439***	4.268***	-0.167
	(0.598)	(1.123)	(1.128)	(0.580)
Republican Incumbent	0.876	6.135***	-5.248***	-0.813
	(0.743)	(1.352)	(1.312)	(0.736)
Third Party Incumbent	0.324	-5.794	6.104	-0.735
	(4.710)	(4.958)	(4.147)	(4.586)
Democratic Governor	2.176	3.930	-1.769	-2.085
	(5.455)	(3.586)	(3.487)	(5.477)
Republican Governor	1.989	3.227	-1.252	-2.160
	(5.465)	(3.645)	(3.536)	(5.482)
Republican % Money	0.731***	0.427***	0.304***	-0.741***
	(0.095)	(0.065)	(0.078)	(0.095)
Democrat % Money	0.736***	0.152**	0.585***	-0.748***
	(0.098)	(0.062)	(0.081)	(0.098)
Lt. Gov. Democrat	0.473	-0.930	1.397	-0.356
	(0.631)	(1.301)	(1.227)	(0.620)
Lt. Gov. Republican	0.978	3.562**	-2.586*	-0.624
	(0.678)	(1.576)	(1.453)	(0.649)
Lt. Gov. Third Party	-3.135	-2.151	-1.019	2.707
	(9.801)	(6.770)	(3.859)	(9.817)
Closeness of Election	-0.015	-0.073*	0.058	0.019
	(0.024)	(0.040)	(0.043)	(0.024)
Republican % Pres. Vote	0.082	-0.056	0.137	-0.087
	(0.084)	(0.192)	(0.167)	(0.085)
Democrat % Pres. Vote	0.115	-0.103	0.217	-0.121
	(0.085)	(0.189)	(0.168)	(0.084)
Log of Median Income	-5.713**	-8.414*	2.692	5.002**
	(2.433)	(4.429)	(4.259)	(2.320)
Average Age	0.284	-0.455	0.741**	-0.312*
	(0.189)	(0.358)	(0.355)	(0.181)
% Black	0.062	0.026	0.037	-0.057
	(0.042)	(0.090)	(0.093)	(0.042)
% Hispanic	0.017	0.011	0.006	-0.025
	(0.027)	(0.041)	(0.042)	(0.026)
% Other Races	-0.038	0.038	-0.076	0.037
	(0.049)	(0.064)	(0.049)	(0.051)
Unemp. Rate	-0.179	-0.509	0.334	0.035
	(0.172)	(0.354)	(0.353)	(0.169)
% Married	-7.697	-7.938	0.017	8.046
	(11.051)	(18.727)	(18.119)	(10.878)
% Female	0.045	0.347	-0.303	-0.097
	(0.294)	(0.515)	(0.542)	(0.289)
% Hold College Degree	0.007	-0.019	0.027	-0.014
	(0.162)	(0.229)	(0.220)	(0.157)
% Gov't Employees	0.107	-0.097	0.202	-0.089
	(0.159)	(0.226)	(0.204)	(0.156)
Coef of Var. of Income	0.037	-0.041	0.079	-0.032
	(0.033)	(0.052)	(0.053)	(0.033)

Table B.3: (continued)

Vote Share of:	Two Major Parties	Republicans	Democrats	Third Parties
Northeast	0.979	0.634	0.337	-0.720
	(1.222)	(1.665)	(1.687)	(1.180)
West	0.149	0.717	-0.606	0.260
	(1.276)	(2.189)	(2.134)	(1.235)
Southeast	0.853	1.126	-0.276	-0.592
	(1.180)	(1.517)	(1.409)	(1.135)
1977-1980	-0.474	-4.875*	4.441	0.178
	(1.564)	(2.742)	(2.815)	(1.532)
1981-1984	-0.765	-10.230***	9.475***	0.298
	(1.544)	(2.994)	(3.027)	(1.518)
1985-1988	-0.966	-6.474**	5.519**	0.552
	(1.556)	(2.559)	(2.583)	(1.546)
1989-1992	-2.215	-8.360***	6.164**	2.165
	(1.392)	(2.518)	(2.449)	(1.390)
1993-1996	-0.576	-5.075	4.556	0.238
	(1.467)	(3.414)	(3.089)	(1.450)
1997-2000	-2.112*	-4.749**	2.644	2.215*
	(1.244)	(1.939)	(1.841)	(1.223)
Constant	0.815	45.316	-44.385	104.296***
	(21.081)	(34.055)	(31.644)	(20.882)
R^2	0.711	0.611	0.647	0.720
Observations	367	367	367	367

***, **, * mean the coefficient is significant at the 1%, 5%, and 10% levels, respectively.

Standard deviations appear in parentheses below the estimated coefficients.

Table B.4: Full Results from IV Regressions

Vote Share of:	Two Major Parties	Republicans	Democrats	Third Parties
Term Limits	6.845*	4.139	2.731	-6.759*
	(3.996)	(5.930)	(5.854)	(3.870)
Democratic Incumbent	0.786	-3.876***	4.666***	-1.111
	(0.971)	(1.419)	(1.415)	(0.933)
Republican Incumbent	1.147	6.294***	-5.135***	-1.079
	(0.988)	(1.437)	(1.308)	(0.976)
Third Party Incumbent	-0.925	-6.527	5.585	0.492
	(4.460)	(4.439)	(4.636)	(4.425)
Democratic Governor	5.045	5.614	-0.577	-4.906
	(6.126)	(4.364)	(4.084)	(6.135)
Republican Governor	4.746	4.845	-0.106	-4.871
	(6.075)	(4.424)	(4.099)	(6.083)
Republican % Money	0.698***	0.408***	0.290***	-0.708***
	(0.109)	(0.077)	(0.083)	(0.109)
Democrat % Money	0.695***	0.128*	0.567***	-0.707***
	(0.110)	(0.077)	(0.087)	(0.111)
Lt. Gov. Democrat	-0.272	-1.367	1.087	0.377
	(0.962)	(1.378)	(1.361)	(0.962)
Lt. Gov. Republican	2.114	4.229**	-2.114	-1.741
	(1.383)	(1.830)	(1.769)	(1.343)
Lt. Gov. Third Party	1.435	0.530	0.880	-1.786
	(10.842)	(7.910)	(5.326)	(10.812)
Closeness of Election	0.053	-0.085**	0.050	0.039
	(0.108)	(0.043)	(0.046)	(0.030)
Republican % Pres. Vote	0.133	-0.072	0.125	-0.059
	(0.114)	(0.194)	(0.173)	(0.108)
Democrat % Pres. Vote	-0.036	-0.093	0.224	-0.139
	(0.030)	(0.194)	(0.171)	(0.113)
Log of Median Income	-4.999	-7.996*	2.989	4.301
	(3.066)	(4.521)	(4.433)	(2.965)
Average Age	0.423	-0.374	0.799**	-0.448*
	(0.269)	(0.393)	(0.371)	(0.261)
% Black	-0.105	-0.072	-0.032	0.107
	(0.096)	(0.155)	(0.157)	(0.094)
% Hispanic	0.048	0.029	0.019	-0.055
	(0.041)	(0.051)	(0.049)	(0.039)
% Other Races	-0.124*	-0.012	-0.112	0.122
	(0.075)	(0.096)	(0.079)	(0.076)
Unemp. Rate	0.166	-0.306	0.478	-0.305
	(0.277)	(0.441)	(0.431)	(0.274)
% Married	-4.327	-5.960	1.417	4.732
	(13.563)	(19.647)	(18.638)	(13.418)
% Female	0.060	0.356	-0.297	-0.111
	(0.380)	(0.541)	(0.547)	(0.374)
% Hold College Degree	0.534*	0.290	0.246	-0.533*
	(0.294)	(0.453)	(0.424)	(0.286)
% Gov't Employees	-0.130	-0.236	0.104	0.144
	(0.207)	(0.283)	(0.252)	(0.203)
Coef of Var. of Income	-0.025	-0.078	0.053	0.030
	(0.051)	(0.072)	(0.071)	(0.050)

Table B.4: (continued)

Vote Share of:	Two Major Parties	Republicans	Democrats	Third Parties
Northeast	-0.201	-0.059	-0.153	0.440
	(1.553)	(1.939)	(1.835)	(1.474)
West	1.321	1.405	-0.119	-0.892
	(1.640)	(2.437)	(2.353)	(1.602)
Southeast	1.178	1.316	-0.141	-0.912
	(1.273)	(1.593)	(1.428)	(1.213)
1977-1980	3.835	-2.347	6.231	-4.059
	(2.779)	(4.142)	(3.939)	(2.726)
1981-1984	2.163	-8.512**	10.691***	-2.581
	(2.333)	(3.678)	(3.682)	(2.282)
1985-1988	1.813	-4.843	6.674**	-2.181
	(2.181)	(3.190)	(3.180)	(2.127)
1989-1992	-0.558	-7.388***	6.852**	0.536
	(1.856)	(2.752)	(2.664)	(1.849)
1993-1996	-0.754	-5.180	4.483	0.413
	(2.132)	(3.500)	(3.186)	(2.124)
1997-2000	-2.572	-5.020**	2.453	2.668*
	(1.613)	(2.057)	(1.931)	(1.577)
Constant	-8.902	39.614	-48.423	113.850***
	(26.471)	(37.179)	(32.442)	(26.221)
Observations	367	367	367	367

***, **, * mean the coefficient is significant at the 1%, 5%, and 10% levels, respectively.
Standard deviations appear in parentheses below the estimated coefficients.
Instrument is term limits on U.S. Congressmen
The R^2 statistic is not meaningful for IV models and therefore not reported.

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